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REVIEW OF THE IMPLEMENTATION OF THE CONVENTION AND OF DECISIONS OF THE FIRST SESSION OF THE CONFERENCE OF THE PARTIES

COMMITMENTS IN ARTICLE 4

Second compilation and synthesis of first national communications from Annex I Parties

Addendum

REPORT BY THE SECRETARIAT

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Explanatory notes

References to "guidelines" are to the "Guidelines for the preparation of first communications by Annex I Parties", document A/AC.237/55, annex I, decision 9/2.
References to "IPCC Guidelines" are to the Draft Guidelines for National Greenhouse Gas Inventories drawn up by the Intergovernmental Panel on Climate Change (IPCC).
References to "dollars" ($) indicate United States dollars.

The following ISO country codes have been used:

Party	Country code	Party	Country code
Australia	AUS	Latvia	LAT
Austria	AUT	Liechtenstein	LIE
Belgium	BEL	Luxembourg	LUX
Bulgaria	BUL	Monaco	MON
Canada	CAN	Netherlands	NLD
Czech Republic	CZE	New Zealand	NZL
Denmark	DNK	Norway	NOR
Estonia	EST	Poland	POL
Finland	FIN	Portugal	POR
France	FRA	Romania	ROM
Germany	DEU	Russian Federation	RUS
Greece	GRE	Slovakia	SLO
Hungary	HUN	Spain	ESP
Iceland	ICE	Sweden	SWE
Ireland	IRE	Switzerland	CHE
Italy	ITA	United Kingdom	GBR
Japan	JPN	United States	USA

The following chemical symbols have been used:

CF_4	tetrafluoromethane
CFCs	chlorofluorocarbons
C_2F_6	hexafluoroethane
CH_4	methane
CO	carbon monoxide
CO_2	carbon dioxide
HCFCs	hydrochlorofluorocarbons
HFCs	hydrofluorocarbons
N_2O	nitrous oxide
NO_x	nitrogen oxides
NMVOCs	non-methane volatile organic compounds
PFCs	perfluorocarbons
SF_6	sulphur hexafluoride
VOCs	volatile organic compounds

The following units of weight have been used:

Gg	gigagram (10^9 grams)
Mt	megatonne (10^6 tonnes)

I. INTRODUCTION

A. Background

1. The United Nations Framework Convention on Climate Change requires each Party included in Annex I to submit, within six months of the entry into force of the Convention for it, information as specified in Articles 4.2(b) and 12. The Conference of the Parties at its first session (COP 1) decided (see decision 3/CP.1)[1] that, until further review, the guidelines for the preparation of first communications by Annex I Parties ("the guidelines") developed by the Intergovernmental Negotiating Committee (see A/AC.237/55, annex I, decision 9/2) should continue to be used by Annex I Parties.

2. COP 1, by its decision 2/CP.1, requested the secretariat to prepare, for consideration by the subsidiary bodies and by the Conference of the Parties at its second session (COP 2), a second compilation and synthesis of first national communications[2], taking into account available review reports. The secretariat accordingly prepared the elements of the second compilation and synthesis report (see FCCC/SB/1996/1 and Add.1). The Subsidiary Body for Scientific and Technological Advice (SBSTA) and the Subsidiary Body for Implementation (SBI) at their second sessions, endorsed the proposed outline and approaches to be taken in carrying out the second compilation and synthesis of first national communications (see FCCC/SBSTA/1996/8, para.52).

B. Approach to the document

3. The second compilation and synthesis of first national communications from Annex I Parties consists of three parts: the executive summary (FCCC/CP/1996/12), the main report (this document) and the tables of inventories of anthropogenic emissions and removals and projections for 2000 (FCCC/CP/1996/12/Add.2).

4. The second compilation and synthesis report on first national communications covers 31 Annex I Parties which submitted their national communications by 1 May 1996, that is, all Annex I Parties except Belgium[3], the European Community[4] and Lithuania[5], plus

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[1] For COP 1 decisions see FCCC/CP/1995/7/Add.1.

[2] The term "national communications" includes communications from the regional economic integration organization included in Annex I to the Convention and should also be interpreted as including any supplementary information provided to the secretariat by Parties.

[3] Submission due date 15 October 1996.

[4] Submission due date 21 September 1994.

Liechtenstein and Monaco which, though not listed in Annex I, have also submitted their communications. Belarus, Turkey and Ukraine, although included in Annex I, have not yet ratified or acceded to the Convention. The first compilation and synthesis report (see A/AC.237/81) presented information contained in national communications from 15 Annex I Parties.

5. This report also draws upon in-depth reviews (IDRs) of communications from 21 Annex I Parties undertaken by international teams of experts and coordinated by the secretariat. The main results and findings of the in-depth reviews are incorporated into the text of this report where appropriate, thus responding to the request made by the SBSTA at its first session that a synthesis of in-depth reviews be presented for its consideration at a later session and transmission to COP 2 (see FCCC/SBSTA/1995/3). Details regarding the due dates, submission and receipt of the national communications can be found in document FCCC/CP/1996/13.

6. This compilation and synthesis report provides an overview of the implementation of the Convention by the Parties[6] that have provided information through national communications and IDRs, noting trends and patterns, areas of convergence or divergence, data gaps and other findings, including the overall effects of policies and measures. The document generally follows the outline and structure of the first compilation and synthesis report.

7. A number of suggestions for revisions to the guidelines for the preparation of national communications aimed at making them more consistent, transparent and comparable, based on submissions from Parties and the experience from the review process, are included in document FCCC/SBSTA/1996/9; some methodological issues are discussed in addenda (FCCC/SBSTA/1996/9/Add.1 and Add.2) to that document. An overview of the review process, as well as suggestions for the schedule of submission of national communications, are included in document FCCC/CP/1996/13.

8. In accordance with decision 2/CP.1, the second compilation and synthesis report includes, as appropriate, the names of Parties in the narrative text, bearing in mind the facilitative and non-confrontational nature of the process. For the sake of conciseness, Parties are referred to in the text, using the three-letter ISO country codes (see explanatory notes above); full country names are also used occasionally. When referred to in examples Parties are listed in the English alphabetical order of their country codes.

9. In order to make this report more readable the main body contains narrative text with graphs and illustrative tables, whereas technical data, such as inventory and projections tables

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[5] Submission due date 22 December 1995.

[6] All references to "Parties" in this document are to "Annex I Parties", unless otherwise indicated.

on which the above visual materials are based, are included in document FCCC/CP/1996/12/Add.2.

10. The work undertaken in preparing the present document has resulted in the updating of existing databases and in the generation of a substantial amount of background documentation on climate change policies, such as energy efficiency and transportation policies, and the situation in countries with economies in transition (EITs). Some of this documentation would merit wider dissemination and publication, e.g. in the form of a series of technical papers.

11. The national communications total over 3,000 pages, not including additional information made available to review teams during the in-depth reviews. This additional information represented several thousand pages for each Party reviewed, so only a small fraction of it made its way into the in-depth review reports and the present document. The secretariat takes full responsibility for the content of this report and acknowledges that some mistakes may have crept in owing to the large amount of information that had to be processed in a limited period of time. It would be grateful if Parties could draw its attention to any such mistakes so that the necessary corrections can be made at a later stage.

II. NATIONAL CIRCUMSTANCES

12. In accordance with the reporting guidelines, all 33 national communications submitted by Parties contain a description of the national circumstances in which current and planned activities take place pertaining to the implementation of the Convention. The description of these circumstances offers a wide range of information and varies widely among reporting Parties as to their scope, focus and level of detail. These national circumstances form the basis upon which climate change activities are currently being formulated and implemented. Although these circumstances should not be seen as justifying the varying degree to which the various Convention commitments are met, they greatly improve the understanding of the approaches followed by each Party, the extent to which policies and measures are or can be implemented, in which sectors of the economy they are most effectively introduced and the types of policy instrument used. The differing national circumstances influence each Party's scope for action and the associated costs and benefits.

13. The description of country-specific circumstances has been considerably enriched through the process of in-depth reviews. Each in-depth review report has attempted to reflect, to the best of the review teams' knowledge, the challenges faced and constraints encountered by Parties in their climate change programmes. In-depth reviews have attempted to understand the different policy options and projection scenarios based on a careful consideration of the national circumstances of reporting Parties. Also, in the in-depth analysis of different greenhouse gas (GHG) emission profiles, the reviews have increased knowledge about the national circumstances which determined such profiles.

14. Important factors for any country are its natural endowments and the physical characteristics of its territory. Descriptions of national circumstances did not always refer to the full area of the Party's territory either because parts of territory have been excluded upon ratification or accession to the Convention, or have not been considered for other reasons. Typically, natural endowments determine a country's share in international energy markets, the energy mix used for electricity production, heating and transport, energy production profiles, etc. A country's energy demand is related to its economy, its land area, its latitude and climatic conditions. Among Parties one can observe a wide range of starting points regarding natural endowments, from Parties highly dependent on energy imports to major exporters of coal, natural gas and electricity, from Parties highly dependent on hydro and nuclear energy to Parties which rely mainly on fossil fuels.

15. Key determining factors in energy demand are the degree of complexity of a country's economy and the consumption patterns of its population. The living standards of the population, its size and density, its growth rates and dispersion in the national territory and its economic welfare relate to energy needs in any given economy. These needs define a country's emission profiles depending on the energy intensity in national economic activity, dependence on energy imports and/or on export of energy-intensive goods, composition of economic sectors and transport infrastructure. The overall structure of the economy and a country's energy profile usually indicate which are the largest and fastest growing sources of greenhouse gases. For reporting Parties, the energy production and transformation and transport sectors are the largest source of CO_2 emissions. These Parties do differ in terms of their domestic energy supply and demand, their access to energy markets and the extent to which they use or have the potential for renewable and non-fossil energy sources, as well as for energy efficiency and conservation programmes.

16. Major differences in energy pricing across Parties are also a determinant in explaining the differing energy demand levels and, consequently, emission levels in the various sectors of their economies. There have been significant differences in current and historical prices of energy commodities in these Parties. Energy pricing policies and associated subsidies have been decisive for the feasibility of energy efficiency measures, as well as for the adoption of more ambitious mitigation measures.

17. The agricultural and waste sectors, their share in national income and technological development tend to determine CH_4 and N_2O emissions in reporting Parties. The share of these sectors in the economy also varies considerably among reporting Parties, although they are consistently less significant than in the developing world. While some Parties are largely self-sufficient in agriculture, other Parties rely heavily on imports.

18. In several Parties most of the economically and environmentally viable hydropower potential has been developed over the last decades. While this development may continue in a few of them, in other Parties the hydro and/or nuclear options are becoming less viable, increasing the dependency of these Parties on carbon intensive energy sources. For several Parties the enhancement of sinks, in particular forests, is an important part of their efforts

aimed at reducing total net emissions. For some Parties, enhancing sink capacities seems more viable than the adoption of mitigation measures, while other Parties do not emphasize sink enhancement in their climate change programmes. Many Parties have protected considerable forest areas from economic utilization, and some implement programmes to protect these carbon reservoirs from anthropogenic degradation.

19. Equally important to the understanding of a country's climate change activities is a description of policy instruments available to the governments as a function of constitutional powers accorded to central and state governments. Political systems also influence a country's approach to mitigation and implementation of policies and measures. In some federal systems, the central government has only limited control over natural resource use, implementation of energy or transport policies, the levying of energy taxes, the administration of regulatory instruments, etc. In some Parties climate change policies have to be mutually agreed by central and provincial or state governments before funding is allocated. The in-depth review process is especially helpful for understanding the constraints and approaches used by those Parties in which provinces and states play an independent role in national policy-making. The institutional framework of each government and the level of independence of its agencies or ministries are also important factors related to climate change policies and measures. In many reporting Parties inter-ministerial committees have been established to support coordination and monitoring of such measures. In these Parties this is seen as an important step towards the integration of climate change considerations into economic and energy policies.

20. During the in-depth review process it has become apparent that the level of public awareness about climate change and about major sources of GHG emissions varies considerably across Parties. While in some countries, interest groups are actively involved in climate change policy-making and related international negotiations, in other Parties climate change is still perceived as a vague environmental problem. In many cases, climate change concerns are not yet integrated in decisions affecting the economy as a whole and consumption patterns of the population.

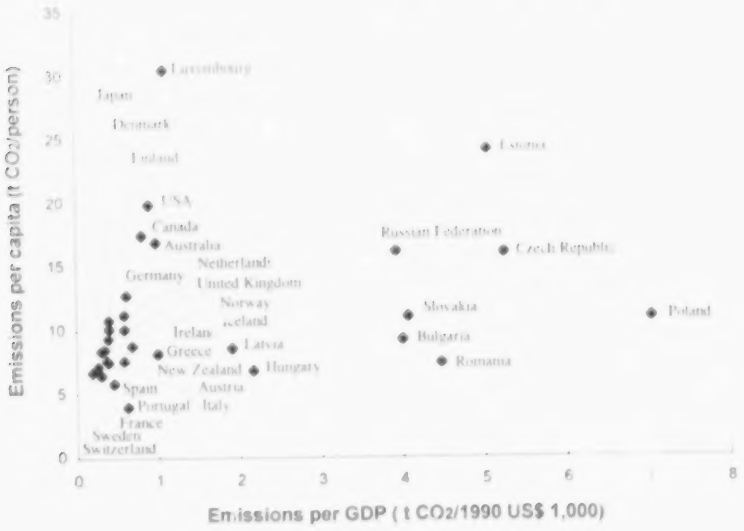
21. In all EIT country Parties the transition to market economies has been characterized by deep economic crisis, the collapse of traditional foreign markets and a sharp decrease in domestic consumption and industrial output, resulting in drastic drops (up to 40 per cent) in gross domestic product (GDP). As an important consequence of this economic restructuring process, GHG emissions have decreased significantly compared to the period before the crisis.

22. The EIT countries have been characterized by a high share of industry in national income, with a resulting high energy intensity level per unit of output and high dependence on energy imports or on indigenous fossil fuel resources. These circumstances have defined their GHG emission profiles, as well as their choice of the most appropriate, efficient and cost-effective policies and measures to mitigate climate change. The Russian Federation is a special case in this regard, owing to its role as one of the world's largest energy exporters.

Governments in many of these countries promote energy efficiency in order to decrease dependence on imported fuel and enhance energy security, but the profound structural changes in their energy and industrial sectors there are still large potentials for improvements in energy efficiency.

23. In-depth review reports on EIT countries have tried to capture the specific challenges faced by this group of Parties in view of the economic recovery experienced by some in recent years. In virtually all EIT countries a process of price liberalization and the establishment of energy prices consistent with international market prices (often by eliminating subsidies) has been an inherent part of the transitional process. The primary targets of this process have been the rationalization of energy resource use and the promotion of energy efficiency, while meeting basic social needs. Linked with important social changes, which include changes in lifestyle and in the range of private sector activities, new environmental legislation has been introduced in EIT countries. Enhancement of this legislation in EIT countries and its reinforcement has been reported as an important contribution to their mitigation policies.

24. Based on their specific national circumstances and commitments with respect to their population and to the international community, several Parties have established their own national targets, not all equally binding. These national targets are summarized in table 3 at the end of this document.



Source: CO_2 emissions data - UNFCCC secretariat, GDP data - UNCTAD.

Figure 1. CO_2 per capita emissions versus CO_2 emissions per unit of GDP, 1990.

25. Overall, national communications and their in-depth reviews reveal a growing consensus that climate change causes are intrinsically related to energy policies and that gains in energy efficiency make sense in economic terms while also improving a country's emissions profile. As economies overcome recession, climate change concerns, together with improvements in energy efficiency and more rational use of national resources, are gradually being considered in conjunction with more strategic issues such as national energy security and diversification in supply sources.

26. The wide range of national circumstances can be illustrated by considering CO_2. Figure 1, in which per capita CO_2 emissions are plotted against CO_2 emissions per unit of GDP, gives such an illustration. Low CO_2 emissions per unit of GDP with high emissions per capita may indicate high energy efficiency and consumption levels. High emissions per unit of GDP with high emissions per capita may reflect inefficient use of fossil fuels and/or a high share of fossil fuels, in particular coal, in the energy mix. Low emissions per unit of GDP with low emissions per capita could mean that the Party has a high share of hydro or nuclear power in its energy balance (non-fossil fuel, hydro, nuclear and other sources, from 20 to 63 per cent in AUT, CHE, FIN, FRA, ICE, LAT, NZL, NOR, SLO, SWE)[7] while having high living standards, or that the Party has a relatively small economy compared with other Annex I economies with the same population size. Relative "positions" of Parties are also the result of significant differences in current and historical prices of energy commodities. This figure suggests that, in spite of major differences in national circumstances, there are common characteristics for some groups of Parties, which could be taken into account in developing further commitments under the Convention.

III. INVENTORIES OF ANTHROPOGENIC EMISSIONS AND REMOVALS IN 1990

A. Presentation of results

27. Inventory data for CO_2, CH_4, N_2O, international bunkers, other GHGs and ozone precursors for 1990 appear in tables A.1 to A.8 in document FCCC/CP/1996/12/Add.2. Each table is accompanied by explanatory footnotes and a brief analytical overview. As a result of the different ways of reporting used by Parties, it was necessary to present CO_2 emission and removal data from land-use change and forestry separately; this permits the data to be presented in a consistent and coherent manner. Tables A.9 and A.10 present CO_2 and CH_4 per capita emissions and relative percentage of fuel type for each reporting Party. Figure A.1 shows the relative proportions of different greenhouse gases for each Party, and the aggregate values for all Parties, based on calculations using global warming potential (GWP) values approved by the IPCC (1994).

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[7] See FCCC/CP/1996/12/Add.2, table A.10.

28. All Parties but Monaco (which indicated that emissions other than CO_2 were negligible) presented emission estimates on a gas-by-gas basis for the three main greenhouse gases, CO_2, CH_4 and N_2O, as well as the ozone precursors, CO, NO_x and NMVOC. Twelve Parties provided estimates for PFCs, two for HFCs (reflecting the fact that these substances were generally introduced after 1990 as substitutes for substances controlled by the Montreal Protocol) and six for SF_6. Twenty Parties presented separate data on emissions from international bunkers[8] for the base year, as requested in the guidelines, four of them providing CO_2 emissions only.

29. CO_2 was confirmed to be the most important anthropogenic greenhouse gas for the reporting Parties, representing 80.7 per cent of total GHG emissions by these Parties. Fuel combustion was reported to be the source of 96.6 per cent of total CO_2 emissions (excluding land-use change and forestry), with most of these emissions coming from energy and transformation industries and transport (38.5 and 26.2 per cent, respectively). Percentage distributions of CO_2 emissions by source categories are provided in figures 1 and 2. Emissions from bunker fuels on average were equivalent to 2.8 per cent of total CO_2 emissions of the Parties reporting them, with the Netherlands having the highest figure of 24 per cent. No removals were reported for gases other than CO_2, managed forests accounting for most carbon removal.

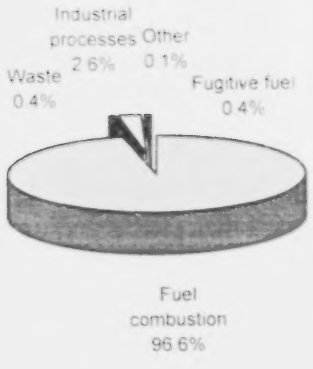

Figure 1. Distribution of CO_2 emissions by category (excluding land-use change and forestry)

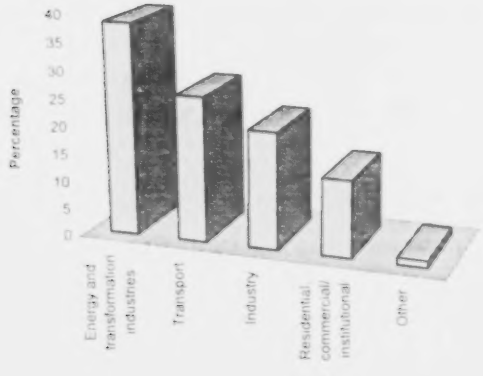

Figure 2. Distribution of CO_2 emissions by sub-source category

[8] Emissions from fuel sold to any air or marine vessel engaged in international transport.

30. The guidelines required Parties to use the IPCC Guidelines in estimating, reporting and verifying inventory data. Twenty-eight Parties reported their inventory data using the summary table recommended by the IPCC or similar consistent formats. Hungary and the Russian Federation (partially) and Liechtenstein, Poland and Romania presented their 1990 estimates in other formats not consistent with the IPCC Guidelines. Romania presented only per capita emissions without disaggregation among different source/sink categories but, like Poland, also presented estimates for the base year using the IPCC format.

31. Parties used two basic approaches to calculating emissions from energy consumption: a top-down approach, as described in the IPCC default methodology, and a bottom-up sectoral approach. Sometimes a mixture of both approaches was used. Based on the information available to the secretariat, a predominantly top-down approach was used by 17 Parties, and a bottom-up approach by 16 others. Among the latter group, seven Parties (AUT, ESP, FRA, IRE, ITA, LUX, POR) used the CORINAIR methodology, but presented their inventory data in the IPCC format. Liechtenstein and Poland presented their inventory for 1990 in the CORINAIR format.

Box 1. Principal problems connected with emission estimates for land-use change and forestry

In the opinion of many reporting Parties, scientific uncertainties and difficulties in data collection and different coverage resulted in low confidence in net emission figures and a lack of comparability among countries. Some Parties expressed reservations in relation to the reliability of the IPCC default methodology and its applicability to their conditions. This issue requires more scientific work to overcome existing difficulties. With results presented using only IPCC standard data tables it was not possible to reconstruct inventories for this subcategory.

The principal problems identified were:

(a) Lack of a common reporting framework for emissions from the above-mentioned subcategory;

(b) Different assumptions used to define anthropogenic activities and ways to consider them for reporting emissions;

(c) Different assumptions on utilization and decay of wood products, and consequently on CO_2 sequestration in them, which affect the way emissions are estimated;

(d) Different assumptions regarding biomass combustion emissions in the estimates of CO_2 net emissions from changes in the "forest and other woody biomass stocks" subcategory;

(e) Tree categories defined by the IPCC Guidelines seem to be unsuitable for some countries.

32. Twenty-three Parties provided land-use change and forestry CO_2 estimates which encompassed removals. For Australia and Estonia the emissions for this category were positive, i.e. corresponding to a CO_2 source rather than a sink. Canada, Greece, Iceland, Ireland, Liechtenstein, Luxembourg, Monaco and Portugal did not present estimates, but Canada announced that a detailed study on this subject was almost finished. The majority of those Parties indicated that the high level of uncertainty was an obstacle to presenting reliable estimates in their first communications and that they intended to remedy this in future. Poland and Romania did not give estimates for 1990, but presented them for their respective base years. Eight of the 15 Parties whose inventories were analyzed in the first compilation and synthesis, updated their land-use change estimates during the in-depth reviews (and Austria presented estimates for the first time). This highlights the uncertainties pertaining to emission estimates in this category.

33. Comparison and aggregation of emissions and removals from managed forests was made difficult by the level of uncertainty associated with the estimates and the different ways of reporting them. Nearly half of the Parties which reported emissions in this category presented them as net sink values and did not distinguish emissions from removals. The rest reported emissions (from harvest and other losses) and sequestration (growth) separately. Different approaches were used. The IPCC default methodology or similar methods were followed by 11 Parties. The rest used either their own methods based mainly on a direct measurement of the net growth of the forest carbon stock or a variety of yield quantitative models. Some Parties did not document the methods. The quality and coverage of the statistical data on forests varied widely among Parties.

34. The largest source of CH_4 was fugitive fuel emissions (37.8 per cent of total methane emissions), followed by livestock (31.4 per cent) and waste (26.6 per cent). The share of CH_4 fugitive fuel emissions in the EIT countries (68.6 per cent) was much higher than in the Annex II countries (23.0 per cent), mainly because of the high proportion of this type of emissions reported by the Russian Federation.

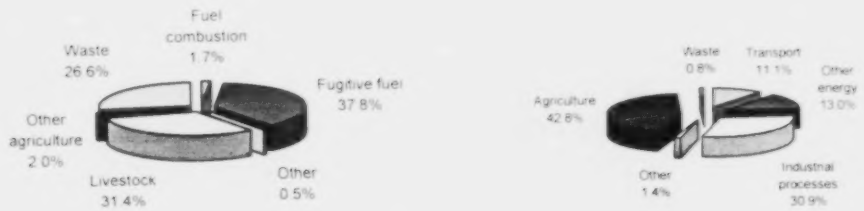

Figure 3. Distribution of CH_4 (left) and N_2O (right) emissions by source and sink category (percentage).

35. The largest source of N_2O emissions was agriculture (fertilizer use), with 42.8 per cent of total emissions of this gas, followed by industrial processes (30.9 per cent). The latter figure could be less reliable because eight Parties did not report emissions in this category and three more Parties provided only aggregated national N_2O emissions. The distribution of CH_4 and N_2O emissions by source and sink categories is presented in figure 3.

36. At the time of writing, 19 Annex I Parties have submitted to the secretariat inventory data for the years subsequent to 1990 (some of the data were reported in national communications), as requested by decision 3/CP.1, although not all of them reported data for 1994. The available data are contained in tables C.1 to C.5.[9] Figure 4 presents relative percentage changes in CO_2 emissions for these Parties in comparison to 1990 unadjusted inventory data.

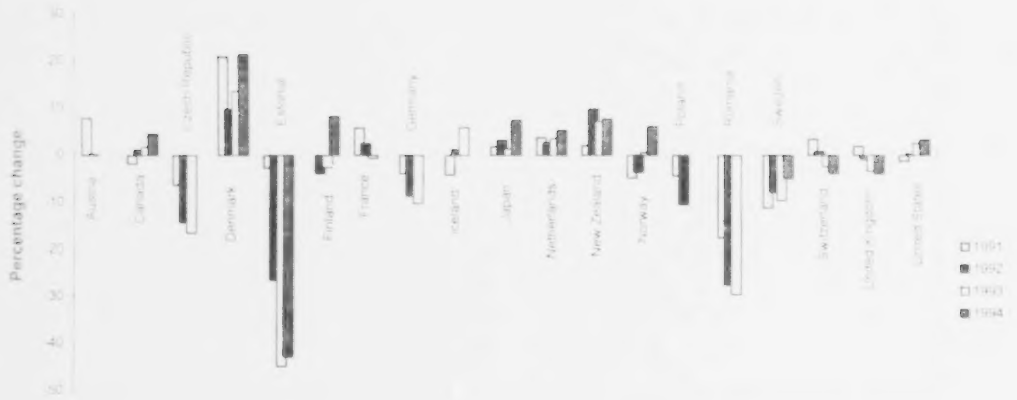

Figure 4. **Percentage change in CO_2 emissions inventories (excluding sinks) in 1991-1994 with respect to 1990.**

B. Methodological issues

1. Transparency and comparability

37. In order to ensure transparency, Parties were requested to provide enough information so that their inventories could be reconstructed from national activity data, emission factors and other assumptions. However, the IPCC minimum documentation standards to ensure

[9] See FCCC/CP/1996/12/Add.2.

transparency in reporting inventory data were not always followed. Sixteen Parties provided the IPCC standard data tables, which expedited the comparison of aggregate emission factors and activity data. For some source/sink categories such as fugitive fuel emissions, industrial processes, solvents, enteric fermentation, waste and agricultural soils, this proved to be sufficient information to ensure transparency. For other categories, the necessary explanations of methods and data used and the level of detail at which the estimates were calculated (including descriptions of intermediary calculations involved) were missing in a majority of national communications.

38. In general, the more complex methods were less likely to be fully documented or independently verifiable. Insufficient documentation also made it difficult to understand if miscalculation, double-counting, omission or deviation from the IPCC Guidelines had occurred. This situation was significantly improved by the submission of additional information by the Parties, especially during the in-depth reviews. In the opinion of the expert teams which participated in this exercise, almost all visited Parties were able to provide full information, allowing verification of data and reconstruction of inventories, although this material had not been included in national communications. Still, the teams also noted substantial differences in both quality and completeness of inventories from different Parties.

39. Analysis of inventory data indicates that 18 Parties (AUS, AUT, CAN, CHE, CZE, DEU, DNK, ESP, FIN, GBR, ITA, JPN, LAT, NLD, NOR, NZL, SWE, USA) provided enough information to reconstruct and assess their inventory data (with the exception of land-use change and forestry for some of them). For nine of these Parties (AUS, AUT, CHE, CZE, DNK, FIN, LAT, NZL, SWE) the information needed to reconstruct the inventory was made available during the in-depth reviews. In-depth reviews thus prove to be a valuable source of additional information, significantly improving transparency and comparability of inventory data.

40. Data for a majority of emissions were comparable, in particular on a gas-by-gas basis, yet many Parties departed from the guidelines, used different assumptions, defined source/sink categories differently, or omitted gases and/or categories included by other Parties. Some Parties had difficulty in converting other inventories, mainly CORINAIR[10], to the IPCC format but others did so successfully.

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[10] CORINAIR is the component dealing with air emissions inventories of the European Community's CORINE (Coordination d'Information Environnementale) Programme.

Box 2. Principal reporting problems

Top-down and bottom-up approaches: reporting requirements

For those Parties which used the top-down approach and provided only the IPCC standard data tables, CO_2 emission estimates were not appropriately documented. The apparent fuel consumption and aggregated emission factors presented in those tables were not sufficient to fully reconstruct the inventory. Elements necessary to ensure transparency include detailed information on approaches and methods used, data sources, treatment of feedstocks, percentage of carbon oxidized, heating values and other assumptions.

Twenty-five reporting Parties developed CORINAIR inventories in 1990. Some preferred to use this inventory, rather than prepare an IPCC inventory. The IPCC Guidelines presented recommendations on how to report the results from the CORINAIR system in an IPCC format. Inventories calculated with other methods do not necessarily generate the same results as those based on the IPCC methodology. This had implications for the comparability of data reported by the Parties. This kind of problem was detected in several cases, but was almost resolved by some Parties, such as France, Italy and Spain, mainly using the CORINAIR-IPCC interface developed by CITEPA (Centre interprofessionnel technique d'études de la pollution atmosphérique, France).

However, these approaches were not sufficient to ensure the transparency required. For those Parties using a bottom-up method, it was necessary to present detailed information on activity data and emission factors used to estimate each source category. This was done by Italy and Spain which did not present IPCC standard data tables. On the other hand, France and Portugal followed the guidelines and presented those tables, but their inventories could not be reconstructed owing to the lack of disaggregated emission factors and activity data in some categories. These facts highlight the different information requirements for Parties using top-down and bottom-up approaches.

Feedstocks and industrial processes

According to authoritative sources, iron and steel are produced in 29 reporting Parties. However, only 13 of them reported emissions in this category. For those Parties which used a top-down approach, these emissions could be included in the fuel combustion category. For those which reported them separately, the information provided made it difficult to see whether double-counting was avoided, or whether the coke used in iron and steel production was not assessed as feedstock. For those Parties using a bottom-up approach which did not report them separately, those emissions could be miscounted. Generally this information was not clearly explained by the Parties in the national communications. However, for some Parties the iron and steel CO_2 emissions could have importance. For example, in a few Parties, they represent up to 10 per cent of total CO_2 emissions, excluding the land-use change and forestry category. Similar problems were encountered with the CO_2 emissions from other industrial sources, such as non-ferrous metals and petrochemicals.

Waste

Only 18 Parties reported CO_2 emissions from waste, 12 of them from waste incineration activities, but also seven from landfills. Fourteen Parties included these values in total CO_2 emissions and four Parties excluded them altogether. Both approaches could be a deviation from the IPCC Guidelines, either by including CO_2 from organic waste combustion or aerobic decomposition of biogenic products (paper, food wastes, etc.) in the total or by excluding CO_2 emissions from fossil fuel-based products, such as plastics and hydrocarbons. Some Parties, such as the Netherlands, Norway, Spain and the United Kingdom estimated quantitatively the share of each, excluding the former and including the latter, properly following the IPCC Guidelines.

41. Two Parties made adjustments to their inventory data. The Netherlands, in addition to providing actual emission estimates, adjusted its CO_2 emission estimates upwards to take account of warmer climatic conditions, and presented this adjusted figure as the working figure. Denmark adjusted its actual emission estimates for 1990 to take account of electricity imports and expressed a preference for presenting this figure as the working figure.

42. Electricity adjustments, if used without precise guidance, may result in double-counting or miscounting of CO_2 emissions among countries, because the electricity trade often involves several countries. Other factors complicate the estimation and use of adjustments, such as differences among GHG emissions from different forms of electricity production (fossil fuel, hydro or nuclear) and the variability of electricity trade. Some Parties expressed concern about this issue and requested guidance to deal with it. In the relevant tables in this report the unadjusted inventory figures which were provided by Denmark and the Netherlands are presented alongside the adjusted ones.

43. Several Parties noted that 1990 had not been a normal climatic year but did not adjust their inventory data, although for information purposes Finland, Sweden and the United States presented adjusted emission estimates either in their national communications or during the in-depth reviews. France and Switzerland used temperature-adjusted information for comparison with projection figures.

2. Completeness

44. The degree of completeness of greenhouse gas and precursor emission inventories varied widely among Parties. More than 90 per cent of Parties reported GHG emissions for activities where default IPCC methodologies were available, in particular, total CO_2 emissions from fuel combustion and cement production, CH_4 emissions from enteric fermentation, animal waste and landfills and N_2O from fertilizer use. Reporting of fugitive CH_4 emissions amounted to 84 per cent. Most of the Parties either used methods other than those recommended by IPCC or improved the default methodologies to suit their national conditions.

45. In the land-use change and forestry sector, managed forest net emissions were reported by 75 per cent of Parties. This figure was higher for EIT countries (89 per cent). Conversely, the latter's reporting level for other industrial process emissions, excluding cement production, was less than 33 per cent, almost half of the overall level. As default methodologies were not available for any category of precursor emissions, the reporting level for these was generally low in a majority of source/sink categories. NMVOC emissions in the solvent use category were reported by 72 per cent of Parties.

3. Level of uncertainty

46. Eighteen Parties provided information on levels of uncertainty either on a gas-by-gas basis or at the source/sink category level, among them Australia, Denmark, Finland, New Zealand and Spain, which did so during the in-depth reviews. Nine Parties (CAN, CHE, ICE, ITA, JPN, NLD, NOR, POR, SWE) also provided a self-assessment of the completeness and quality of their inventories using the IPCC recommended format. Sixteen Parties did not follow the guidelines relating to the reporting of uncertainties, mentioning only brief considerations or not mentioning the matter at all.

47. Apart from Sweden and the United Kingdom, Parties did not explain how the uncertainties were arrived at in national communications. Only a few Parties presented quantitative information on uncertainties, but with differing assumptions. During the in-depth reviews difficulties were often encountered in determining the precise meaning of the categories "low", "medium" and "high" used in data quality tables and in understanding how uncertainty levels were evaluated.

48. Despite variations in the ways of determining confidence levels for GHG emissions, the qualitative and quantitative information made available by Parties may be summarized as follows:

GHG	Confidence level	Remarks
CO_2	High, except for land-use change where it is low	Energy and cement production emissions have an error range of up to ±10%
CH_4	Medium for energy and livestock and low for waste and fugitive fuel emissions	Medium ranges from ± 20 to ± 35%
N_2O	Medium for energy and industrial emissions and low for agriculture	Low ranges from > 25% up to two orders of magnitude from the lowest to the highest

For precursors the confidence level for NO_x is high to medium and for CO and NMVOC medium to low.

49. In terms of CO_2 equivalents using 1994 IPCC global warming potentials (time horizon 100 years) for the dominant gases CO_2, CH_4 and N_2O, close to 80 per cent of the emissions can be classified in the highest reliability category lying within an error range of ± 10 per cent. If the estimates for greenhouse gases other than CO_2 were more reliable, this figure would be higher. Several Parties, among them Canada and Germany, reported that some estimates for CH_4 and N_2O emissions were also highly reliable. However, generally lower confidence levels for CH_4 and N_2O emissions, together with the different assumptions related to evaluation of uncertainties, indicate the importance of continuing to develop and present quantitative estimates of uncertainties wherever possible.

C. Summary conclusions

50. Pursuant to Articles 4.1(a) and 12.1(a), all reporting Parties communicated national inventories of anthropogenic emissions by sources of GHG not controlled by the Montreal Protocol on substances that Deplete the Ozone Layer. With reference to Article 4.6, four EIT Parties established a year other than 1990 as the base year for reporting, but they also provided a 1990 inventory (see also section VIII.E). The following base years were chosen: Bulgaria 1988, Hungary 1985-1987, Poland 1988 and Romania 1989.

51. CO_2 was confirmed as being the most important anthropogenic GHG for the reporting Parties. Fuel combustion was the largest source of CO_2 emissions, mostly in the energy and transformation industries and transport. No removals were reported for gases other than CO_2, managed forests accounting for most carbon removal. The largest source of CH_4 emissions was fugitive fuel emissions, followed by livestock and waste. The largest source of N_2O emissions was agriculture (fertilizer use), followed by industrial processes, although the reporting level for this category was low.

52. Information provided by Parties about uncertainties in emission estimates demonstrated that estimates for most GHGs (in terms of global warming effects) have a high degree of reliability, despite the lower confidence levels for CH_4 and N_2O emissions, thus providing a solid basis for implementing climate change policies and monitoring the effects of measures. Nevertheless, quantitative estimates of uncertainties should be further improved wherever possible.

53. The degree of confidence associated with CO_2 data, in particular for fuel combustion, is high and the estimates are consistent with other authoritative sources of information. In spite of that, some inconsistencies and difficulties in aggregating and comparing inventory data have arisen, owing to different definitions being used for source/sink categories and different assumptions made, and gases and/or categories included by some Parties being omitted by others, many of which departed from the guidelines. The technical analysis of inventories, based on national communications, supporting material and in-depth reviews revealed information gaps. Adjustments in inventories used by some Parties were a factor complicating comparability, consistency and transparency of the emission estimates. Suggestions on treating this issue are presented in document FCCC/SBSTA/1996/9/Add.1.

54. The analysis of inventory data demonstrated that more than 90 per cent of Parties reported GHG emissions for those activities where default IPCC methodologies were available, although the majority of Parties either used other methods or improved the default methodologies to suit their national conditions. This analysis highlights the importance of improving default methodologies and developing new ones for additional important sources or sinks.

55. During the preparation of both the first and second compilation and synthesis reports and the in-depth reviews, Parties showed a willingness to provide additional supporting data and made substantial efforts to improve the quality of their inventories. Problems of insufficient transparency as well as methodological problems mainly proved to be due to a lack of experience in preparing inventory data and imperfections in the guidelines.

56. In general, almost all the problems identified during the review of Annex I Party inventories can be solved by applying the current state of the art in preparing and reporting GHG inventories. The land-use change and forestry source category is an exception which requires more scientific work to overcome existing difficulties.

57. It is recognized that the review and synthesis of inventories was facilitated by the existence of the guidelines, which Parties made considerable efforts to follow in communicating inventory data. Substantial progress was made especially during the in-depth reviews, in understanding the problems of inventory reporting and in identifying areas for further work. With further improvements in the guidelines and reporting, more comprehensive, comparable and consistent national inventory data could be obtained.

IV. POLICIES AND MEASURES TO LIMIT ANTHROPOGENIC EMISSIONS AND PROTECT AND ENHANCE SINKS AND RESERVOIRS OF GREENHOUSE GASES AND THEIR SPECIFIC EFFECTS

A. Approach to the review of policies and measures

58. All reporting Parties provided a description of the policies and measures they have adopted to implement their commitments under Article 4.2(a) and (b). The presentations varied significantly from Party to Party both in detail and approach, illustrating the diverse contexts in which policies and measures are implemented and the difficulties of presenting them in a way that is comparable to other countries. The guidelines request that, to facilitate transparency, enough detail should be provided about each policy and measure, including its objective in terms of the gas and sector targeted; the type of policy instrument used; its status of implementation; how it is expected to function and interact with other measures; and indicators of progress.

59. In order to present the results of analysis of policies and measures in a more informative and useful way, and taking into account suggestions made by Parties during the second sessions of the SBSTA and the SBI, discussion highlights commonly used measures and/or those which are promising in the opinion of Parties or review teams rather than describing the full range of measures mentioned by Parties in their national communications. The presentation of policies and measures unavoidably presupposes a certain degree of subjectivity in presenting examples or lists of actions taken by Parties. This task was further complicated by the large number of measures (more than 1200 individual measures were identified and entered into the database) and their differing nature - from nation-wide

programmes to actions by local communities. The fact that some policies or measures are not reflected in this document does not imply any judgment on their respective merits but is due to the necessity to limit the synthesis to a manageable size.

60. In the conclusions adopted at its second session, the SBSTA, *inter alia*, requested the secretariat to explore ways to use tables in the compilation of policies and measures (see FCCC/SBSTA/1996/8, para.52). The heterogeneous character of information on policies and measures and the lack of a uniform structured approach to its presentation in both national communications and supplementary documentation made available during the in-depth reviews precluded presentation of this information in tabular form. Suggestions for revised guidelines are contained in document FCCC/SBSTA/1996/9.

61. All Parties specifically targeted CO_2 emissions but GHGs other than CO_2 were also subject to a wide range of measures aimed at reducing emissions. A substantial number of measures are at the implementation stage with their effects expected in the medium to long term. For example, development and implementation of new and renewable energy sources (for example, biomass, geothermal, wind, solar energy) are often seen as important and promoted by various means, but only in a few countries do non-hydro renewables exceed 10 per cent of the present energy balance.

62. The choice of the type of policy instrument was generally related to national circumstances, such as political structure, overall economic situation, the organization of the energy sector or social considerations. They were implemented by both state and local governments, as well as the private sector. The IDRs confirmed a tendency to prefer policies that put limited burdens on public budgets, and in some cases even improved their balance.

B. Analysis of trends in policies and measures by sector

63. In this section, policies and measures reported are presented on a sectoral basis. For the sectors information is provided on:

(a) The main gases addressed in the sector;

(b) The main aims of the policies and measures, the main policies and measures identified and the types of policy instruments used;

(c) An assessment, where possible, of the relative contribution of measures in individual sectors vis-à-vis the overall emissions reduction efforts of Parties.

1. Cross-sectoral measures

64. Many measures aim to achieve multiple policy objectives. For example, improved energy efficiency is an approach pursued in most sectors and all of the national communications indicate that it is a primary means of reducing emissions while improving economic efficiency and energy security. Cross-sectoral measures are used in conjunction with a variety of policy instruments to strengthen the interaction between the measures.

65. The majority of Parties reported taxing energy - a policy tool which has been used for many years primarily to raise revenue, rather than for climate-related purposes, or to internalize some externalities. At national and often regional level the scope and level of energy prices and taxes vary considerably depending on fuel mixes and other variables. Broadly, prices and the level of taxes on fuels *vis-à-vis* their carbon content often indicate an inverse relationship, with the most carbon-intensive fuels at lower levels and subsidized in some cases.

66. In recent years, some Parties have implemented tax schemes to reflect the carbon content of some or all fuels. Additionally, as a number of countries indicated in their communications, carbon/energy taxes could be part of their basket of policies and measures, if the taxes were adopted at an international level to avoid competitiveness concerns. The principal objective of carbon/energy taxes is to improve energy efficiency, in particular for fossil fuel, and consequently to limit or reduce emissions of greenhouse gases and other pollutants. Five Parties (DNK, FIN, NLD, NOR, SWE) have instituted carbon/energy taxes, while several others have considered doing so but subsequently rejected or deferred the matter. A number of national communications from members of the European Community refer to proposals for a carbon/energy tax that have been under consideration since 1992.

67. For the Parties that have introduced carbon/energy taxes a number of observations can be made. Carbon/energy taxes apply to the use of fossil fuels mostly in primary production and/or at end-use consumption. Although uniform rates for all emissions are seen as being cost-effective, rates for various fuels are applied at differing levels in the various sectors, with exemptions for some uses and some fuels. In some countries that have a carbon/energy tax, revenues are redistributed to reduce income tax and business contributions to social security, or to fund energy efficiency improvements through investment grants. In others revenues go to the general government budget and may thus offset other taxes ("greening the tax burden"). In general, carbon/energy taxes:

(a) Are part of a package of measures to achieve emission reductions;

(b) Have been part of structural tax reform;

(c) Do not apply to all uses of energy that produce CO_2 emissions in the same way on a per unit of energy or a per ton of CO_2 basis;

(d) Do not apply to energy-intensive industries, including non-energy emissions, and others (international bunkers) due to international competitiveness and trade concerns;

(e) Afford special treatment for electricity which is generally taxed as such, not via CO_2 taxes, but there are exemptions for preferred fuels or technology.

Box 3. Carbon tax in Finland

In 1990, Finland introduced Europe's first explicit carbon tax imposed on fossil fuels according to their carbon content and set the tax at a relatively low level. In 1994, the tax level was increased. It was also restructured to include a fiscal component with tax differentiation for diesel and petrol; and a carbon element and an energy element replaced the pure carbon component. This modified the regime such that 60 per cent of the relative weight is on the carbon component and 40 per cent on the energy element. Only a few exemptions are provided. This is perhaps the most straightforward example, while other carbon/energy tax schemes are more varied, which makes comparisons between countries too detailed for the synthesis.

68. The projected effects of the carbon/energy taxes implemented to date are difficult to isolate from the effects of other policies and measures targeted at energy use. As is the case with many measures related to energy use in the various sectors, the effectiveness of carbon/energy taxes is intertwined with the rate of capital stock turnover and technological change. Several Parties, however, have estimated the effects of carbon/energy tax schemes: Denmark expects that the tax scheme in combination with other measures such as subsidies for energy efficiency improvements could bring about a 4.7 per cent reduction in CO_2 emissions from 1988 levels in 2000; the Netherlands expects that their regulatory energy tax introduced on 1 January 1996 will reduce total CO_2 emissions by about 1.5 per cent in 2000. Sweden expects that changes in taxes will account for up to 70 per cent of expected total reductions (of 14 per cent compared to a baseline) from all programmes.

69. In addition to economic instruments and regulatory measures, most Parties include voluntary approaches in their climate change strategies on a sector-specific, e.g. energy-intensive industries, and on a cross-sectoral basis. Voluntary approaches seem to be attractive to policy makers as a low-cost flexible tool for achieving reductions in GHG emissions. Cost-effective responses may result but specific estimates were difficult to obtain, in particular, since few countries have experience with the instrument over time. The communications indicate that the majority of voluntary agreements focus on improved energy efficiency, reduced CO_2 emissions and are targeted on the industrial sector. Voluntary agreements to reduce emissions of non-CO_2 gases are being developed by some Parties. The approach is also employed in the energy transformation, residential/commercial, agriculture and, increasingly, transport sectors.

Box 4. LTA in the Netherlands

Voluntary agreements in the Netherlands have been developed in the second half of the 1980s. The policy objective of the long-term agreements (LTAs) in industry is to push energy efficiency beyond existing trends, without resorting to new regulations or price increases, and to help achieve CO_2 emission targets. It is a well defined structure in which the commitments of the Government and the industry are specified in the LTA, which is a legal contract. In many ways, these "voluntary agreements" are negotiated contracts, for example, aimed at improving energy efficiency.

Steps in establishing and implementing of long-term agreements in Netherlands

Step 1: *Netherlands' Organization for Energy and Environment (NOVEM) approaches the selected industrial sector for a LTA.*

Step 2: *The sector records its willingness to undertake energy conservation in a declaration of intent with the Minister of Economic Affairs.*

Step 3: *The sector energy conservation potential is inventoried, under the guidance of experts.*

Step 4: *The results of the inventory are translated by NOVEM and the sector concerned into a multi-year plan which forms part of the LTA.*

Step 5: *The LTA is signed by the sectoral association, the individual firms and the Minister of Economic Affairs. It embodies the following subjects:*

- *objective;*
- *energy conservation strategy;*
- *the Ministry's role;*
- *energy-saving plan for individual firms;*
- *monitoring energy efficiency;*
- *clause providing for amendment or premature termination;*
- *duration.*

70. Voluntary is a relative term in the context of climate-related policies and measures. As reported in the national communications and in-depth review reports, voluntary approaches vary considerably in their structure and approach from Party to Party and within Parties. As a policy instrument, they range from relatively informal statements of intent to highly structured agreements with commitments both from the government and the other side. Characteristics of the voluntary approaches tend to reflect the objectives of the programme: if the strategy is basically "no regrets", then the structure tends to be supple in order to encourage wide participation; whereas if the objectives or targets call for efforts beyond "business-as-usual", then the agreements tend to be more structured, some with enforcement elements.

71. Voluntary approaches in other Parties (e.g. CAN, GBR, JPN, USA) tend to be less rigidly structured with more emphasis on wide participation and an incentive structure based on public recognition, rather than on a legal basis. These voluntary agreements take the form of energy efficiency and CO_2 reduction measures with industry, public authorities and manufacturing associations, and they contain various forms of corporate commitments. Self-monitoring and reporting with no enforcement characterize these voluntary approaches. For example, voluntary agreements with vehicle manufacturers in Germany and Japan define targets for improving fuel efficiency globally for the new vehicle fleet of a specific weight category, without specifying how they are to be met. Manufacturers are obliged to apply mandatory labelling for fuel consumption in Japan, while German manufacturers must monitor and report average fuel efficiency data to the federal Government.

72. Falling somewhere in between these two ranges are the voluntary agreements in industry, as exemplified in Germany and New Zealand where subsector targets have been set on an energy efficiency or CO_2 emissions basis. The agreements are not legally binding and there are no penalties for underachievement. In both of these examples as well as in some other Parties, there is a strong governmental warning that additional regulatory or tax measures will be implemented if the results of the voluntary measures appear to be inadequate.

73. During the IDRs the teams often noted that voluntary approaches have limitations, since their success depends upon the participation, targets, and evaluation. Effective monitoring and reporting are essential to determine the changes in energy use or reductions in emissions resulting from the initiatives. Other important characteristics include the time-frame, enforcement and rewards. Several Parties have or are developing multi-sectoral reporting of emissions in association with voluntary agreements (e.g. AUS, CHE, NLD).

74. The IDRs demonstrated that, with some exceptions, voluntary agreements were in the early stages, so it was not always possible to make valid observations about their projected effectiveness. As there is much diversity in the structure of voluntary agreements and in the economic and political context in which they function, drawing parallels from this heterogeneous group of measures was difficult. Overall, a common theme is that voluntary approaches are an outcome of concerns that climate change objectives will not be reached without additional innovative, consensus-building approaches which have the active support of programme participants in partnership-type undertakings that go beyond traditional regulatory approaches.

75. Other overarching, cross-sectoral measures reported by Parties often included research and development, and information and education. These are discussed in more detail in sectoral sections where appropriate.

2. Energy and transformation industries

76. The energy and transformation sector includes activities related to the production of energy, transformation of primary energy to secondary forms such as electricity generation and crude oil refining, and distribution to end-users. This sector contributed 38 per cent of total CO_2 emissions from Annex I Parties in 1990, with the proportion of CO_2 emissions in individual Parties ranging from 0.3 per cent (ICE) to more than 70 per cent in some EIT Parties. Many Parties noted that the energy supply and transformation sector is their largest emissions source. The majority of GHG emissions are CO_2 from burning fossil fuel to produce electricity. Some Parties also have significant amounts of emissions from the production and transport of fossil fuels. CH_4 is emitted during the production and, in particular, distribution of natural gas, and small amounts of N_2O and precursors are produced from burning fossil fuels.

77. Policy objectives emphasized by many Parties were fuel switching to low- or no-carbon fuels for electricity generation, improved efficiency in end-use through actions by the supply industry to influence demand, and improved efficiency in the conversion and distribution of energy. Measures in this sector were reported by the majority of Parties and most frequently were directed at CO_2 emissions from electricity generation.

78. Among the most effective measures, Parties mentioned regulatory reform to promote competition in energy supply and distribution, removal of subsidies on coal, extending natural gas and district heating networks, time-of-day or seasonal electricity pricing, building nuclear power plants, and as a measure that could have large potential in the longer term, research on renewable energy. Among the most often implemented measures, Parties reported financial incentives (such as government funding or subsidies for district heating, and electricity tariff reform), research and development and economic incentives for renewable energy, and demand side management by utilities.

79. Measures chosen by different Parties depended to a large degree on the structure of their energy markets, regulatory systems, endowments of natural resources, and the fuels used for electricity generation. Parties with little or no fossil fuel based electricity generation (e.g. FRA, ICE, NLD, NOR, SWE) reported that reductions in emissions were difficult in this area, whereas Parties with large amounts of coal or lignite in the fuel mix reported that measures in this sector were very important and effective (e.g. CZE, ESP, GBR, GRE, POL). Parties with significant centralized district heating noted a range of measures to improve the efficiency of heat distribution or to switch to low- or no-carbon fuels.

80. Structural and regulatory reforms were reported by some Parties as being a promising approach to reducing GHG emissions, though emission reduction was not the primary purpose of the reforms. In addition to improving economic efficiency, Parties reported that energy market reforms can facilitate energy supply from independent gas-fired and renewable electricity producers and provide incentives for more efficient use of resources. The communications and IDRs confirmed the trend to deregulate and enhance competition in the

energy markets, but it was often emphasized that the long-term effects on emissions were uncertain and would depend on the regulatory regime within new market structures (e.g. AUS, DEU, ESP, GBR, NLD, NOR, NZL, SWE, USA).

Box 5. Energy market reform in the United Kingdom

Over the last ten-fifteen years, the United Kingdom has moved to establish a competitive energy market. Government grants and price supports for coal have been removed and the sector has been privatized. Gas and electricity production and transmission have been privatized (except nuclear which is due to be privatized in 1996). Most importantly, the structure of the energy sector has been changed with accompanying regulatory reform to encourage competition in electricity and gas production and distribution. Competition in natural gas and electricity markets has been phased in with choice of suppliers to all end-use consumers planned for 1998. Competition in the electricity market has developed as a result of a series of steps:

- Privatisation of the former state-owned generating board and the formation of regional distribution companies;
- A requirement for the two dominant electricity producers to sell capacity;
- Separation of electricity transmission and distribution from generation;
- Removal of monopoly distribution "franchise" areas;
- Regulations to ensure third-party access to the grid;
- Regulations which cap price increases below the rate of inflation.

In addition to enhancing competition and providing choice for consumers, the effects of this reform will reduce greenhouse gas emissions in the United Kingdom significantly, largely due to fuel switching. From a base of zero in 1990, it is expected that 16-18 GW of electricity from combined cycle gas turbines will displace coal-fired stations by 2000. This switch from coal to gas decreases CO_2 emissions from electricity generation sharply.

81. The envisaged development of Nordic and Europe-wide electricity and gas markets was noted as having large potential for significant reductions in emissions (DEU, NOR), and the potential for CO_2 reductions through electricity trade was emphasized (FRA). It was also noted that although integration of electricity markets could work well with other programmes to reduce CO_2 emissions, it could also put greater restrictions on unilateral action and lead to emissions rising in countries where electricity is produced for export (SWE). The IDRs indicated that there is a general uncertainty related to the structural development of this sector, and consequently to its emissions, where deregulation could contribute to shifts in investment patterns and fuel choices, as well as day-to-day operating procedures.

82. Fuel switching, in particular increasing the use of natural gas, was emphasized by Parties with large shares of fossil fuel in their electricity fuel mix as having tremendous potential to reduce emissions if used to replace coal (e.g. ESP, GBR, GRE). Removing subsidies was also noted as being a very important policy option (e.g. POL, SLO). Other economic instruments used to promote natural gas are pricing policies favouring gas, and

subsidies for conversion of coal-fired plants to natural gas (e.g. DNK, JPN). Direct government funding and low interest loans were also used to extend the natural gas infrastructure (e.g. ESP, GRE, IRE, ITA, JPN), and to build gas-fired capacity (e.g. GRE, HUN). Regulations and guidelines to promote the use of natural gas are reported to convert coal plants to gas (e.g. DNK), to set emission limits on gases such as NO_x, SO_2 and CO that encourage a shift from coal to gas (e.g. CZE, USA), as well as to ensure that independent power producers have access to grids (e.g. AUS, GBR, USA).

83. EIT Parties reported that one of the most effective mitigation policies is to increase the share of natural gas in primary energy supply. The Russian Federation expects substantial increases in the proportion of natural gas in the primary energy balance, whereas the Czech Republic and Bulgaria reported several programmes for fuel switching and extension of natural gas supply networks.

84. Although renewable energy is recognized as being competitive in niche markets or at favourable sites, many Parties noted that the contribution of renewables, except for large-scale hydro schemes, is likely to remain small for some time. Reasons given were that many forms of renewables are still more expensive than fossil fuels, and other barriers to broader use of renewables remain. Government funding, and often industry funding as well, is used by practically all the Parties for research, development and demonstration of renewable energy technology. An innovative measure reported was government co-ordination assistance to facilitate collective purchases of renewable technology by utilities (USA). A wide range of economic instruments are used to promote renewables that are already competitive or are close to being so, such as solar, wind, biomass and geothermal energy. Tax incentives such as accelerated depreciation, exemption from income tax, and lower energy taxes for renewables are also used (e.g. AUS, CZE, ESP, GRE, JPN).

85. Nuclear energy is emphasized by some Parties as having great emission reduction potential (e.g. BUL, CZE, FRA, RUS, SLO). Investment in new nuclear plant, often as an alternative to coal, were also mentioned (e.g. BUL, CZE, FRA, JPN, RUS, SLO). Some Parties reported that they have made commitments to phase out nuclear power (e.g. SWE) or that nuclear power was not an option because of environmental and safety concerns (e.g. AUS, AUT, IRE, NZL). Four EIT Parties (BUL, CZE, RUS, SLO) explicitly consider nuclear power as an option to mitigate emissions. In the Czech Republic nuclear power will replace electricity produced by coal-fired plants that do not meet new environmental regulations. The impact is an estimated reduction of 11,300 Gg of CO_2, about 7 per cent of 1990 emissions. In Bulgaria, new nuclear units are expected to replace old ones and the projected effect is a saving of 9,000 Gg CO_2. It was noted, however, that the acceptability of the nuclear option is uncertain.

86. The importance of giving demand-side measures equal weight with energy supply investment was noted by several Parties. Demand-side management (e.g. information, funding for energy efficiency investments, buy-back of old appliances) and integrated resource planning are commonly implemented through voluntary agreements with utilities or

even initiated by utilities themselves (e.g. AUS, CAN, DNK, FRA, JPN, NLD, SLO, USA). Regulations are sometimes used, for example, to require utilities to implement cost-effective demand-side projects (USA) or to require utilities to explore demand-side potential in power planning. Some governments changed regulations to allow utilities to recover the cost of demand-side projects through energy tariffs or placed a surcharge on energy (e.g. GBR, NLD, USA). Some Parties noted (especially during the IDRs) that demand-side initiatives were not necessarily seen as relevant by the participants in competitive energy markets, because other bodies (information centres, etc.) could provide the same services.

87. Electricity tariff reform to allow or require time-of-day and seasonal pricing was reported by many Parties as a way of reducing peak demand (e.g. AUT, FRA, ITA, JPN, POR). In one EIT country a regulation requiring metering was issued to make consumers aware of the costs of energy consumption (CZE). All EIT Parties reported price liberalization and removal of subsidies.

88. Measures to improve the efficiency of existing plants vary widely among the various Parties. Regulations setting limits on NO_x and SO_x emissions were reported as being an effective way to encourage more efficient use of cleaner fuels (e.g. DEU, GBR, ITA, SLO). Government funding was accorded to convert coal-fired plants to more efficient combined cycle gas turbines (e.g. ITA), to improve the efficiency of lignite plants (e.g. GRE), and for general energy-saving measures in supply (e.g. HUN). Research and development of various kinds was reported, for example to enhance plant performance and fuel handling methods. Voluntary approaches to improving maintenance and operating practices were reported (e.g. CAN, IRE, NLD, USA). Other instruments were mentioned such as financial incentives for cost-effective hydro upgrades, regulations to improve the efficiency of electricity and gas utilities, legislation allowing investors to pay for upgrades to federal hydro facilities and sell the incremental power (USA), and regulations requiring modernization of coal-fired plants (e.g. POL). Five EIT Parties (BUL, CZE, HUN, POL, RUS) identified significant technical and market potential for new energy technology, e.g. combined cycle gas turbines, cogeneration and fluidized bed combustion.

89. Some Parties reported financial incentives or government funding to encourage combined heat and power (CHP) (e.g. CZE, FIN, GRE, JPN, NLD, SWE), or guidelines or regulations to facilitate the sale of excess power (e.g. AUS, ITA, JPN, LUX, NLD). Other measures reported include voluntary approaches to encourage CHP (e.g. AUS, DNK, GBR, NLD), and legislation to ensure grid access.

90. Extending district heat networks and connecting more consumers was seen as a promising option to reduce emissions in countries with district heating schemes. In Finland about 45 per cent of buildings (up to 95 per cent in the cities) are connected to district heating, often from CHP plants, on a voluntary basis. Other measures in this area include:

(a) Regulations to require households to connect to the network and a ban on conversions to electric heating in areas with district heat or gas networks (e.g. DNK);

(b) Legislation to promote the use of CHP in district heat systems and public buildings (e.g. DEU, GRE);

(c) Subsidies, government funding, low interest loans, tax incentives or investment support for district heat networks and communities using waste heat (e.g. BUL, CZE, DEU, DNK, IRE, JPN, LAT, NLD, POL, SWE);

(d) Research on district heat and cooling technology (e.g. CAN, JPN, all Nordic countries).

91. Centralized heat supply to households and the public sector has a high penetration and priority in the energy supply of EIT Parties. Most of them (BUL, CZE, LAT, POL, RUS), identified options to increase and upgrade heat supply systems. In Latvia, it is estimated that reconstruction of heat distribution networks will reduce CO_2 emissions by about 3 per cent and the installation of meters about 10 per cent. Bulgaria reported reconstruction of heat supply networks and reduction of losses that would lead to a 1,000 Gg CO_2 reduction annually, which is considered one of the most cost-effective measures on the basis of the cost per ton of carbon saved.

92. A few Parties reported measures to reduce losses or improve efficiency in transmission and distribution of electricity. Government funding was reported to be used to replace transformers and extend transmission lines and reduce leaks in gas pipelines. Research was reported on reduction of transmission losses and super-conducting technology. One Party (USA) reported labelling of efficient transformers, linked to voluntary action to purchase efficient transformers where cost-effective, and dissemination of information on transformers to utilities, as well as the organization of group purchases to obtain lower prices.

3. Industry

93. Greenhouse gas emissions in this sector arise from the combustion of fossil fuels and as by-products from industrial processes (see also subsection 6 below). Policies and measures relating to emissions from industrial processes are discussed in a separate section.[11] Industry accounts for 20.9 per cent of energy related CO_2 emissions and a small share of energy-related CH_4 and N_2O emissions, in addition to its substantial electricity consumption. In some Parties this sector is the largest energy consumer among the end-use sectors and one of the major contributors to greenhouse gas emissions (BUL, CZE, FIN, ICE, JPN, RUS, SLO, SWE, USA). All but three communications (LIE, MON, ROM) reported policies and measures to control emissions in the sector.

94. Policies and measures in this sector differ substantially in their objective, scope and effect in different Parties, but with few exceptions Parties highlighted the importance of the

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[11] Some Parties treated the use of fossil fuel as a reducing agent in technological processes in the category of industrial energy end-use, but in this document it is discussed in the industrial processes section.

measures within this sector given its high share of emissions. Several Parties expected the emissions from this sector to remain at the same or a lower level than in 1990 as a result of economic restructuring and technology modernization (e.g. BUL, CHE, ITA, POL, SLO). This tendency is stronger in EIT countries as a result of both economic recession and changes in the pattern of economic development. In some Parties, however, not only was the share of emissions from industry very high, but also a moderate or substantial growth of emissions was expected (e.g. CAN, NLD, NZL, SWE, USA). Some Parties reported that this sector provides the greatest technically and politically feasible opportunities for emissions reductions among all the sectors (GBR, RUS, USA).

95. Measures reported in this sector mainly targeted CO_2 emissions. In implementing policies and measures within the industrial sector Parties emphasized the importance of using a wide range of policy instruments such as voluntary agreements, actions and programmes; legislation, regulation and standards; financial incentives, including grants, tax reliefs, third party financing, direct subsidies; liberalization of energy prices and removal of subsidies from energy. The issue of international competitiveness was frequently raised as posing some restrictions on the types and strength of measures that could be implemented; several Parties pointed out that international cooperation is needed to resolve this issue.

96. Most Parties highlighted energy efficiency improvement, especially in the use of electricity, switching to fuels with lower carbon content, and technology development aimed at using energy and raw materials more efficiently as the most important areas of intervention in the industrial sector.

97. In planning measures to improve energy efficiency, Parties often split the industrial sector into two major groups: energy-intensive industries and non-energy-intensive industries, the former including iron and steel, non-ferrous metallurgy, pulp and paper, the chemical industry, and the building materials industry. Energy costs are a significant part of overall costs in industries that belong to the energy-intensive industry group (e.g. AUS, FRA, ITA, JPN). Many Parties identified significant potential for energy savings for this group of industries (e.g. BUL, FRA, ITA, RUS, SLO, USA), and some regarded voluntary agreements as the most effective approach (e.g. AUS, CAN, ITA, NLD). In sectors with low or medium energy consumption, the cost of energy does not have a significant impact on production costs so there is relative insensitivity to energy prices and a tendency to neglect energy-saving options. Financial support, grant schemes, energy auditing, and better information about energy conservation methods were therefore mentioned as essential for implementing energy efficiency policies (e.g. AUS, DEU, FIN, GBR, ITA, NLD, NOR, POR).

98. Economic instruments were often used by Parties to improve energy efficiency and reduce CO_2 emissions in the industrial sector. Economic instruments rather than regulations were intended to ensure that savings were made where they were most cost-effective (e.g. GBR, NOR, SWE). Most Parties reported comprehensive energy-saving programmes and special funds to support them. The scope of programmes is very broad, from energy

efficiency improvement by such measures as lighting improvement and space and water heating, to introduction of new energy efficient equipment.

99. Regulations, standards and guidelines were less often mentioned by Parties in this sector. Many Parties reported drafting or planning to adopt new laws on energy efficiency and harmonization of energy-saving concepts and energy policies by regulations and guidelines as an essential step toward improving the regulatory framework intended to enhance energy efficiency (e.g. AUT, BUL, CHE, CZE, ITA, NLD, NZL).

Box 6. Administrative standards for energy efficiency in Japan

Japan has introduced administrative standards to promote the rationalization of fuel combustion and heating, prevention of heat losses, and recovery and utilization of waste heat for businesses with an annual fuel consumption of at least 3,000 kl of crude oil or electricity consumption of at least 1,200 kWh.
The energy consumption is monitored and, if the progress is unsatisfactory, additional measures are implemented.
In 1993 the measures were strengthened and the target of 1 per cent annual energy improvement in unit energy consumption was established.

100. Almost all Parties highlighted the role of information, education and training to promote energy efficiency in industry and often reported the dissemination of information as an element of energy-saving programmes (e.g. AUT, DEU, FIN, GBR, ITA, NLD, NOR, POR, USA). Pilot projects and demonstration projects in many cases served to promote new energy efficient technologies, to accelerate technological development and to bring new technologies to the market. Governments usually supported these projects by direct government funding or by subsidies (e.g. DEN, GBR, ITA, NOR, NZL, SWE).

4. Residential, commercial and institutional

101. This sector covers energy end-use in households, businesses, and the public sector. The majority of GHG emissions caused by activities in this sector are CO_2 emissions from electricity production to meet energy demand for space and water heating, lighting, refrigeration, and office equipment. This sector is the target of the largest number of measures reported, but given that most emissions from electricity production are attributed to other sectors it contributed just 10 per cent of 1990 CO_2 emissions from reporting Parties. The proportion of CO_2 emissions from this sector in the various Parties ranges from 3 per cent (AUS) to 44 per cent (CHE).

102. The policy objective most frequently emphasized for the residential/commercial sector is enhanced energy efficiency to reduce emissions and to improve economic efficiency. In several Parties (AUT, FIN, NOR, NZL, SWE and some EITs) biomass is a significant fuel. There was some mention, but much less emphasis, on fuel switching and promotion of

renewable energy. Parties reported many measures aimed at reducing CO_2 emissions through improved energy efficiency. The extent to which a particular policy instrument is used may be related to national circumstances, such as a preference for economic instruments (e.g. GBR) or voluntary agreements (e.g. NLD). However, most Parties employ a package of measures including regulations, economic instruments, voluntary approaches, and information and education. The need for a coordinated approach with national, state and local governments, the private sector, and consumers was emphasized by a number of Parties (e.g. CAN, GBR).

103. Among the most effective measures, Parties mentioned energy efficiency standards for new buildings, raising energy prices, or improving their transparency, and efficiency promotion campaigns on television. Among the most often implemented measures, Parties reported building insulation or energy efficiency standards, financial and tax incentives to improve energy efficiency in buildings, technical assistance and information for building design and construction, appliance efficiency standards, and public awareness campaigns.

104. A number of Parties (e.g. CAN, FIN, GBR, GRE, NLD, NZL) reported monitoring programmes for this sector, though indicating that tracking the progress of measures in a sector with many players is a challenge. Estimated emission reductions from the residential/commercial sector vary widely between countries depending on the type and stringency of measures implemented, and on the fuel mix of the energy saved. Some Parties stated that emission reductions can be difficult to calculate because it is often not possible to accurately determine the type of fuel used to produce the electricity but during the IDRs many Parties demonstrated some of the approaches used. Effects were estimated by some Parties, often for packages of measures (AUS, DNK, GBR, GRE, USA).

105. Buildings were the key focus for most Parties' emission reduction strategies in the residential/commercial sector, particularly for EIT Parties. The emphasis is on new construction, where the potential for greater energy efficiency can be achieved most cost-effectively. Some Parties also reported measures to improve the energy efficiency of existing buildings stock where cost-effective improvements are possible during refurbishment.

106. The most frequently reported measures to improve the thermal performance of new buildings were regulations and standards. New or more stringent insulation standards or energy efficiency performance standards were reported by many Parties (e.g. AUT, BUL, CZE, DEU, DNK, FRA, IRE, ITA, JPN, LUX, POL, POR). Some Parties noted, and the IDRs confirmed, that performance standards are more flexible and more cost-effective than prescriptive standards that require specific building materials and techniques. Regulations or guidelines related to energy efficiency in buildings and ventilation and heating systems were reported by several Parties (e.g. DEU, GRE, IRE, LIE). Others reported strengthening building energy efficiency codes or regulations (e.g. AUS, DNK, ESP, GBR, NLD, USA). Some EIT Parties reported that strengthening new building insulation standards is an element of harmonizing codes and standards with those of the European Community (BUL, POL, SLO).

107. Lack of information on availability and cost-effectiveness was frequently mentioned as a barrier to broad market penetration of efficient appliances. Product characteristics other than energy efficiency, such as price, low noise or size are often dominant in purchasing decisions, limiting incentives to produce more efficient appliances.

108. To help bridge this gap, some Parties reported education and information measures to raise awareness and labelling schemes to draw attention to more efficient products. Public awareness and information campaigns are used to raise consumer awareness of energy efficient products (e.g. CHE, DEU, FIN, IRE). Labelling schemes such as energy efficiency or eco labels on appliances were frequently reported, with European countries referring to the European Union refrigerator labelling scheme. This was referred to as a low cost measure.

109. Financial assistance such as subsidies for purchase and installation of more efficient appliances, equipment, and fittings was reported by some Parties (BUL, CZE, GBR, GRE, NLD). Three EIT Parties reported financial support for efficient lighting (BUL, CZE, SLO). Specifically in the public sector, government funding for the replacement of street lighting with efficient sodium lamps was reported by three Parties (BUL, GRE, IRE).

110. All Parties recognized that prices could have a large impact on energy consumption patterns in this sector (e.g. BUL, CZE, GBR, LAT, SLO). CO_2/energy taxes are discussed in the cross-sectoral section, but many countries noted that these, as well as value-added tax (VAT) (e.g. GBR), can have a substantial impact on consumer behaviour, especially in the longer term. EIT Parties stressed the importance of liberalization of energy prices (e.g. BUL, CZE, LAT, SLO), and removal of subsidies on residential heat and electricity (BUL), although in some countries prices for residential heat remain subsidized for social reasons (e.g. ROM) or VAT exemptions on heating fuel are practised (e.g. GBR).

111. Energy and sales taxes or tax reductions were reported frequently (e.g. CZE, DEU, DNK, EST, FIN, FRA, GBR, LUX, NOR, SWE), and tariff reform to ensure that electricity prices reflect costs was reported by several Parties (e.g. AUT, DEU, LIE). Among the financial incentives reported by Parties were: incentives for better energy management (e.g. EST, FRA, GBR), finance for energy saving programmes (e.g. EST), a joint programme for economic recovery in eastern Germany (DEU), community loan programme (DEU), low interest loans for energy efficiency measures (HUN), and discounts on the cost of space and water heating depending on levels of consumption (LIE) were also reported.

112. Most Parties used legislation, regulations or guidelines to achieve technical improvements in lighting, appliances, and equipment. Performance standards were reported by most Parties to remove the least efficient appliances and/or equipment from the market (e.g. AUS, BUL, CAN, CHE, DNK, FRA, GBR, GRE, IRE, ITA, JPN, NLD, NZL, USA). Some Parties noted the development of common standards in the European Community and indicated that standards have greater effect when implemented jointly by trade partners (GBR). Three EIT Parties (CZE, EST, SLO) also mentioned improved

appliance standards in their lists of measures. Many Parties noted that regulations or standards can be effective in encouraging the development of more efficient products.

Box 7. "Golden Carrot" partnerships in the United States

The United States government has formed partnerships with non-profit organizations, utilities, and environmental groups to accelerate the commercialization of highly efficient appliances, by combining financial resources to create a market incentive for the development of more efficient appliances. In the initial "Golden Carrot" programme, a group of utilities pooled $30 million in resources to encourage the design of a CFC-free refrigerator that was 30 per cent more energy-efficient than the federal standard. A similar approach is now being applied to high efficiency commercial air conditioning. Incentives of this type are expected to provide clear market signals for appliance manufacturers to develop and commercialize advanced energy-efficient appliances.

Improvements in appliance efficiency from the "Golden Carrot" programme, together with residential appliance standards, are estimated to contribute the largest reduction potential of all United States measures: 11.8 Mt C out of a total reduction of 108.6 Mt C.

5. Transportation

113. The transport sector, with 26.2 per cent of fuel combustion emissions, ranks second after the energy and transformation industry in its share of CO_2 emissions, and is responsible for approximately 11 per cent of N2O emissions. For seven Parties (AUT, CAN, FRA, ICE, NOR, NZL, SWE) transport was the largest source of fuel combustion CO_2 emissions. Its actual share varies from less than 5 per cent (CZE) to 82 per cent (ICE), reflecting, among other factors, the status of economic development, as well as the fuel mix in the non-mobile energy end-use sector.

114. Twenty-six Parties reported measures that had been implemented or planned in the transport sector. Many Parties indicated in their national communications and confirmed during the in-depth reviews that, in spite of the wide range of measures already in place (e.g. taxes, regulations, standards, promotion of public transport), emissions from this sector are seen as likely to continue to increase. Estimates of the effects of measures being implemented or planned compared to baselines vary widely, partly because many measures have so far been implemented only to a limited extent.

115. Relevant sectoral characteristics are the strong relationship between economic development and transport growth, transport's high dependence on oil, the significant lack of economic potential for fuel substitution in the short term and the resultant short-term menu of policies focused on behavioural change and technical efficiency improvements. It was noted by some Parties that stabilization of emissions from the transport sector would either require

continual technical improvement to counter the effects of transport growth, or a combination of technical improvement and demand management to weaken the link between economic growth and particular forms of transport.

116. Policies and measures in the transport sector, as reported in national communications, are linked to the following policy objectives: improved operational efficiency of transport systems, including energy use and emissions; increased energy efficiency of vehicles; noxious emission reduction and control; and promotion of less carbon-intensive transport fuels.

117. The majority of measures were aimed at goals more closely associated with the Parties' traditional approach to transport policies involving indirect energy saving and emission spin-offs, such as restricting personal car use and road freight and promoting public transport and the carriage of freight by rail or sea.

118. Packages of fiscal, regulatory, and information measures which form part of local and national integrated approaches to transport emission reduction (e.g. AUS, AUT, CZE, DNK, GRE, NLD, NZL, NOR, USA) were possibly the class of measures which demonstrate the greatest potential. Some Parties, in particular EIT countries, noted the links between economic and transport growth, and stressed that the share of public and rail transport should be maintained as a specific measure to mitigate climate change (e.g. NLD, SLO). The IDRs confirmed that this is a challenge in most Annex I Parties.

119. Economic instruments and incentives to influence vehicle design, purchase and patterns of use were regarded as an important class of measures. Vehicles and fuels in particular are already taxed, though there is significant variation in the level of taxes implemented (from 0 to more than 200 to 300 per cent) and proposed among the Parties, as well as the way these are applied (on different fuels, by weight, engine volume, energy efficiency, etc.) (e.g. CHE, DNK, FIN, FRA, GBR, NLD, NOR, NZL, SWE).

120. Measures to improve the average vehicle fuel economy of new cars manufactured or sold in a country (by affecting the development and take-up of energy efficient vehicle technology) have a wide applicability among the Parties, as mentioned by several European Community countries. Such measures have reasonably long lead-times before the effects are felt, as vehicle fleets turn over about every 10-15 years. Regulations and standards introduced in the 1980s by the United States and Canada were notable for their impact. In the period 1978-1990, when corporate average fuel economy standards were being implemented, the average fuel efficiency in the United States increased from 9 to 13 kilometres per litre, and Canadian fuel efficiency exceeded the goal of corporate average fleet fuel economy of 8.6 litres per 100 km. Large increases in the number of vehicle-kilometres travelled over the same period, however, offset these gains in fuel efficiency. The IDRs demonstrated that some measures are under consideration which could achieve similar effects, including new approaches such as "feebate" schemes and voluntary agreements between governments and vehicle manufacturers.

121. Several Parties mentioned that local measures to influence behaviour, such as the promotion of public transport, bicycle use, and traffic management, have the potential to reduce emissions, and can generally be applied relatively quickly if funds are available. The IDRs confirmed a downward pressure on subsidies to public transport as budgets are tightened, and as restructuring or privatization takes place in several Parties. Few Parties reported evidence of progress in improving energy efficiency in the transport sector and in general few measures were directed specifically towards that end. Given the longer lead times for these types of measures, additional efforts to improve the energy efficiency of vehicles and transport systems might be required to improve the mid-term emissions outlook.

6. Industrial processes

122. GHG emissions from this sector originated from several major sources, including PFCs from the aluminum industry, HFCs from the chemical industry, N_2O from adipic acid manufacturing, CO_2 from the cement and lime industry and SF_6 from magnesium production. The sector contributed 2.6 per cent of CO_2 emissions, 29.9 per cent of N_2O emissions, and less than 0.5 per cent of CH_4 emissions. It was the only source of HFCs and PFCs in 1990. Most of the Parties expected the emissions of non-CO_2 gases from industrial processes to decrease substantially over time, driven mainly by measures that were already partly implemented. This trend was confirmed by the 1991-1994 inventory data reported so far.

123. The non-CO_2 gases were primarily subject to measures in Parties with relatively high levels of these emissions (e.g. AUS, CAN, GBR, NOR, USA) which acted to reduce these emissions, partially from existing plants, by improving production technologies, including major process changes. The gases that were most often targeted by measures were HFCs, PFCs and N_2O.

124. Voluntary programmes were reported by Parties as being the most appropriate way of reducing emissions in this sector; other policy instruments were used to a lesser extent. In regard to PFCs, for example, by implementing voluntary programmes Australia achieved a 70 per cent reduction compared to the 1990 level, the United Kingdom obtained a reduction of about 65 per cent within a three-year period, and the United States expects a 50 per cent reduction in the near term.

125. Some Parties also referred to a number of voluntary programmes and measures to reduce CO_2 emissions from cement production by greater use of "dry process kilns" (e.g. CAN), and to reduce SF_6 emissions from magnesium production by improved routines and maintenance (e.g. NOR). In the United States, a partnership approach with the chemical industry to reduce by-product emissions of HFCs from manufacturing operations by 50 per cent was implemented, together with the Clean Air Act, which narrows the scope of uses allowed for HFCs with high global warming potentials where better alternatives exist. In order to reduce N_2O emissions adipic acid producers were investigating different

abatement strategies, including incineration, conversion to recoverable nitrogen monoxide and catalytic decomposition to nitrogen and oxygen (e.g. CAN, DEU, GBR).

126. The majority of Parties, however, reported no measures in this sector given the small share of emissions coming from it. They also assumed the emissions to be constant over time, or indicated that no data were available for more accurate estimates.

7. Agriculture

127. Agriculture is a major source of methane emissions, accounting for 33 per cent of total reported CH_4 emissions, of which 57 per cent resulted from enteric fermentation, 32 per cent from animal waste management, and 5 per cent from rice farming. This sector also accounts for 28 per cent of total reported N_2O emissions. The sector's activities relate to the raising of crops and animals, the treatment of wastes resulting from both activities, and soil emissions resulting from agricultural practices. Emissions of CH_4 are generated by enteric fermentation processes in ruminant animals, by the anaerobic decomposition of animal wastes, by anaerobic processes resulting from rice farming practices, and from the burning of agricultural wastes and open grasslands. Emissions of N_2O result from nitrogen cycling in the soil system, and especially from the use of nitrogenous fertilizers.

128. In the agricultural sector, objectives related to food security, maximizing the production of an uncontaminated food supply and preserving the agricultural environment in order to maintain its productivity, are universal. A wide range of measures are aimed at achieving these objectives, and at the same time taking into account climate change considerations.

129. The majority of measures reported by Parties targeted CH_4 and N_2O emissions. These measures included, among others, regulations and guidelines on improvement of the agriculture structure (e.g. DEU), decreasing the number of cattle and manure production (e.g. NLD), quotas on milk production (e.g. CHE), and limiting the number of animals per hectare (SWE), and economic instruments, such as the abolishment of subsidies on agricultural production (NZL), subsidies for energy-efficient systems in greenhouses (JPN), a levy on ammonia emissions (NLD), subsidies to regulate crop production and on organic farming techniques (CHE).

130. Parties members of the European Community often mentioned the Common Agricultural Policy, which consists of a series of policy directives including the prescription of a reduction in the number of animals per hectare, rationalization of fertilizer use, increased fallowing with crop cover, sustainable agricultural practices, a reduction in guaranteed feed grain prices and fertilizer subsidies, and the protection of water quality from agricultural wastes, among other measures. These practices also have the benefit of reducing emissions of GHGs from this sector.

131. A number of Parties reported measures in this sector directed at substitution of fossil fuels by biomass, such as oil-seed crops or surplus straw, and, as a longer term option, increased cultivation of energy crops. Many measures were reported to be at the research and development stage, with the impact expected in the medium to longer term following their implementation. Such measures included, for example, research and evaluation of measures to reduce emissions from rice paddies and livestock (JPN), to improve the efficiency of nitrogen intake (e.g. AUS, CAN), and to potentially alter the natural balance of enteric bacteria (e.g. NZL).

132. Voluntary agreements were mentioned by some Parties as a part of their national mitigation efforts. These included, for example, reducing summer fallow acreage and revegetating abandoned farmland, using crop residues for composting, animal feed and bedding (CAN), and concluding partnerships with farmers to provide on-farm energy needs with CH_4 from manure and to improve efficiency of nitrogen use (USA). Many Parties reported information, education and training aimed at promoting the extension of biological farming and integrated husbandry and the optimal use of fertilizers.

133. In the transition from a centralized economy with state agricultural enterprises to privatized agriculture, EIT countries all experienced a decline in the agricultural sector. In particular, animal herds were substantially reduced. This has led to a fall in emissions from this sector which generally are not expected to return to their earlier levels in these countries by the year 2000. Nevertheless, some measures were reported by EIT Parties in this sector. For example, soil sampling to determine the quantity of fertilizers to be introduced and the promotion of manure as a fertilizer were reported by Bulgaria, support for using biomass by the Czech Republic, and an action plan to reduce water nitrate contamination in agriculture by Slovakia.

8. Land-use change and forestry

134. Policies and measures in the land-use change and forestry sector were reported by almost all Parties, including Parties which, owing to the high uncertainties, did not provide inventory data for this sector. The discussion focused primarily on CO_2, although in a few cases the minor impact of forest clearing on other gases, such as CH_4, CO, N_2O and NO_x, was also discussed.

135. Policies and measures reported by Parties in this sector predominantly concerned forests, and were frequently implemented through national forestry plans. A varied set of instruments were described. Economic instruments included, *inter alia*, subsidies for initial investments and fiscal advantages, voluntary agreements, research and promotion of awareness. The general objectives of policies were equally diverse, ranging from targets for reforestation and afforestation (e.g. Denmark has an afforestation target of 10-15 km^2/year; Australia's 1 Billion Trees Programme is the country's single largest contributor to mitigation) to improvement of the quality of forests and pest and fire control. In only a few instances, however, was sequestration of CO_2 indicated as an objective of the forestry policy

(for example, in Finland, a specific link to CO_2 sequestration was made in the Forestry 2000 plan).

136. Different Parties use different means of increasing the carbon sink in forests. In countries with a strong tradition in silviculture, such as the Nordic countries, a high proportion of the forest is managed for timber production, with management practices determining the carbon storage. Even in intensively exploited forests carbon sequestration can increase. In other countries, afforestation or reforestation is an important means of increasing the sink, such as in New Zealand. Several forestry management practices to reduce or eliminate natural loss were reported, including deer damage control and protection against fires (for example, by raising awareness and creating fire-breaks).

137. With reference to stocks, some Parties noted that, in addition to sequestration rates, the long-term growth of carbon reservoirs was an important issue to be studied in greater depth in the future. In a few instances Parties reported efforts to preserve the carbon stock of natural forests in reserves (New Zealand's efforts to combat degradation being noteworthy). A few Parties also reported policies and measures to enhance the carbon stored in the pool of wood products (France being a case in point through its promotion of the use of wood in construction; also Germany).

138. Less frequently discussed were policies and measures for carbon stored in soil, possibly as a result of the greater uncertainties in the inventory data. The return of arable land to forestry and grassland, brought about by changes in incentive structure, is occurring in many countries, both within the context of the Common Agricultural Policy reform (EU Regulation No. 2080/92 providing aid for the conversion of arable land to forests) and in Parties not members of the European Community. The conversion of wetlands into forests results in a reduction in CH_4 emissions, with different impacts on soil carbon depending on the natural conditions (negative in the United Kingdom and positive in Finland). The scope for such conversion is now seen as limited compared to the past 20-40 years. The conversion of peatland was also mentioned by a few Parties, both to agricultural land and to forest, with differing impacts according to the type of subsequent land use. Specific policies and measures were not always identified.

139. Agricultural practices (related to, for instance, animal husbandry) that affect the carbon stored in soil were also discussed. Some Parties mentioned the role played by programmes to avert deforestation in preventing soil erosion.

140. One Party, Australia, noted that there might be a need to review the IPCC definition of "anthropogenic" with regard to the deliberate burning of grasslands, which has traditionally been used as a management tool for the prevention of bush fires.

9. Waste management and sewage treatment

141. This sector includes activities related to the landfilling and incineration of solid municipal and industrial wastes, and the treatment of liquid municipal and industrial wastes and sludge. These activities generate a number of GHGs, principally CH_4 and CO_2, and precursors. The sector represented 26.6 per cent of total reported methane emissions in 1990, the percentage in national totals varying widely.

142. In general, countries originally introduced waste management practices in order to deal with the primary problems associated with waste, such as sanitation and health concerns, nuisance odours and, in some instances, safety. As the growth of landfill space was regarded as undesirable in many countries, extensive recycling programmes were initiated, and in some countries incineration was seen as the most feasible alternative to landfilling.

143. In order to meet the dual need to reduce waste volume and at the same time reduce the cost of fuel needed for energy production, many countries introduced waste-to-energy programmes. In addition, methane gas, produced during anaerobic decomposition in both landfills and wastewater treatment facilities, poses both safety and aesthetic problems, and many countries have invested in methane recovery, often for energy purposes.

Box 8. Landfill tax in the United Kingdom

Landfills are the biggest single source of methane emissions and, without implementation of mitigation measures, emissions are expected to increase by 25 per cent over 1990 levels by 2000. Most British waste (roughly 83 per cent in 1990, excluding toxic waste) is currently landfilled. As part of a new waste strategy, the Government has recently introduced the landfill tax which will come into force on 1 October 1996. The tax will be weight-based and set at a standard rate of £7 per tonne, with a lower rate of £2 per tonne for inactive waste. The Government is also considering establishing a trust, supported by voluntary contributions from landfill operators, 90 per cent of which would be refunded by the Government in the form of reduced tax collection. The trust funds would assist with problem solving in waste management, e.g. clean-up of contaminated sites and research into sustainable waste management alternatives. Landfill operators will also be required to collect and use the gas where economically viable. Operators seeking new licences or the renewal of existing licences will be asked to conform to this requirement or risk being denied a license. The Government expects that, thanks to this measure about 80 per cent of the landfill gas at 80 per cent of the sites will in time be collected and used.

144. The majority of Parties reported having national policies or specific regulations related to such waste management practices, either requiring or encouraging waste stream reduction, waste separation, recycling, composting, and landfill aeration. Another commonly reported measure, usually accomplished through voluntary means or economic incentives as opposed

to regulation, was the diversion of waste from landfills to an incinerator, in order to produce power. Many Parties with substantial waste incineration programmes reported that they had set standards for such incinerators.

145. Regulations and guidelines were often mentioned by Parties as implemented or planned measures in this sector. Nineteen Parties reported either implemented (AUS, CAN, CHE, DEU, DNK, FIN, FRA, GBR, GRE, ITA, NLD, NOR, SWE, USA) or planned (CZE, GBR, ICE, NZL, POL, RUS) programmes to recover methane from landfills and use the recovered gas as an energy source. Germany has legislation requiring that old dump sites recover and thermally exploit methane. France has passed a law requiring that after 2002 nothing be landfilled except materials which cannot be recycled, or materials whose beneficial reuse has been exhausted. In the Netherlands, a ban on land-filling of combustible waste is to come into force in 1996. It is expected that this will lead to an increase in energy recovery from waste through incineration.

C. Summary conclusions

146. Mitigation of climate change was one of several reasons for implementing the majority of measures, the main rationale often being economic, in particular for measures improving energy efficiency in all sectors. A significant proportion of the measures were reported as being of the "no regrets" type. It was not always possible to distinguish from the communications between planned and implemented measures, and in the case of measures being implemented, indicators of progress were often missing. This last factor made it difficult to draw a parallel between the effects expected from the most significant measures and the projected GHG levels for 2000; in-depth reviews have been helpful in clarifying these and other issues.

147. Removals of subsidies in, for example, the energy and agriculture sectors were reported to reduce CO_2, CH_4 and N_2O emissions. Deregulation, especially in the electricity sector, was reported as a central factor causing reductions in several Parties. In the EIT Parties, the process of economic restructuring and establishing market prices for energy commodities caused the bulk of the reductions; specific programmes directly aimed at mitigating climate change were often in an initial phase. For the Parties that reported policies and measures in the land-use change and forestry sector, these related mostly to forestry management, often aiming at sustainable utilization. IDRs confirmed that, at present, these practices in general increase the sink capacity.

148. There was no uniform pattern of reporting on the effectiveness of measures across Parties which would enable specific conclusions to be drawn as regards their overall impact or applicability in the various sectors of the economy. The IDRs have addressed policies and measures initiated both before and after the base year, as these were seen by the teams as equally important for the trends in emissions. Information on the effects of individual measures was often sketchy or based on assumptions that were not always transparent; the

cost-effectiveness of measures, including specific information on costs and benefits, was rarely discussed, thus making it difficult to evaluate what measures were the most significant or effective. Those measures which were identified as effective were not necessarily the most frequently implemented, and sectors where descriptions of measures were most detailed or complete were not always the most important emitters or the fastest growing ones. For example, relatively few policies and measures were reported in the transport sector, despite the fact that emissions from this sector are growing rapidly in virtually all Parties. Although the IDRs revealed that considerable fuel and vehicle taxes, technical measures, support for public transport and physical planning measures are in place in several Parties and could slow emissions growth, this growth is still robust.

149. A number of Parties indicated the need to consider policies and measures requiring international cooperation, in particular taxes. Five Parties (Denmark, Finland, Netherlands, Norway, Sweden) had unilaterally implemented taxes aiming at reducing CO_2 emissions, taxing CO_2 only or both CO_2 and energy elements. These taxes had a number of exemptions for reasons of competitiveness (for energy-intensive industries, bunker fuels, fuels for electricity production), which were seen as necessary as long as such taxes were not applied in other countries. A frequently reported, although not yet implemented, policy was the combined CO_2/energy tax under discussion in the European Community. Some Parties to some extent also coordinated among themselves mitigation efforts, such as energy consumption standards for appliances that are sold on regional markets.

150. Some significant reductions were reported and partly implemented in the industrial sector, related to process changes in aluminum production resulting in the reduction of PFC emissions, and in adipic acid production reducing emissions of nitrous oxide. In the waste sector, sorting, recycling and changed landfill management practices in several Parties are expected to yield considerable reductions in methane emissions towards the end of the decade and thereafter. In the residential, commercial and institutional sector, the communications focused on regulations and standards for new buildings as well as on a variety of measures (taxes, demand-side management programmes, information and education) promoting efficient energy use in existing buildings. Some innovative measures, known as "Golden Carrot" programmes (e.g. SWE, USA), were aimed at enhancing the development of energy efficient appliances.

V. PROJECTIONS AND OVERALL EFFECTS OF POLICIES AND MEASURES

A. Introduction

151. Pursuant to Article 4.2 and the guidelines, most Parties provided projections for anthropogenic emissions for the three major gases. More than half of Parties projected precursors and removals by sinks, while several made projections for other gases. A number of Parties completed and updated the projections during the IDRs. Germany and Estonia provided projections after their communications had been submitted, the latter having had

problems establishing the relevant statistics. The basis for the emissions projections in some countries dates back to 1990-1991, while in others this was done in 1996.

152. Several Parties stated that their "with measures" projections, incorporating current policies and measures, did not necessarily reflect what they expected their emission levels to be in 2000 since they intended to develop and implement further measures. The projections provide information on progress made towards the aim specified in Article 4.2 but should be seen in the context of statements on national targets, monitoring of progress and further development of policies and measures. The IDRs have shown that some additional policies and measures are being introduced while others that were included in the projections are not being implemented. Often economic growth has been stronger and energy prices lower than originally expected, causing higher underlying growth.

153. The sections of the communications dealing with projections and effects of policies and measures were very heterogeneous. In an effort to present the information as concisely as possible, the data are set out in tables B.1-B.8.[12] However, it is important to emphasize that projections from one Party are not comparable with those from another because of differences in modelling approaches, key input assumptions, sources projected, the representation of policies and measures, the uncertainties of projections due to national circumstances and adjustments in some of the 1990 levels for temperature anomalies or electricity trade. As was noted by Australia in its communication: "... the most useful way to interpret the numerical values quoted in this chapter is to obtain an appreciation of the order of magnitude of the issues. That is, to draw out their qualitative inferences rather than to apply a rigorous mathematical analysis" (emphasis added).

B. Approaches used and methodological issues

154. Parties used different approaches to estimate their projected emissions, reflecting variations in economic structure, experience and data availability. "Top-down" economic models played a dominant role for CO_2 projections. Some Parties based their projections on sectoral models, typically for the energy and transport sectors. Several Parties, for example Australia and the United States, combined "top-down" models with more technologically explicit "bottom-up" approaches. It is well known that the use of different models can generate significantly different outcomes. Projections of emissions of non-CO_2 gases and of removals by sinks were, in general, based on more disaggregated approaches.

155. Most Parties provided enough information in the communications to allow a third party to obtain a qualitative insight into the approaches used, although the IDRs afforded a deeper understanding. A few Parties did not provide sufficient documentation on their work (partly since this was not available in one of the working languages of the secretariat). The

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[12] See FCCC/CP/1996/12/Add.2.

IDRs confirmed that Parties have very different traditions in developing and utilizing quantitative projections. In several of Parties there is heavy involvement of relevant ministries, while others have projections carried out by independent consultants. The adequacy in relation to actual development of policies and measures varies.

156. The transition from centrally planned to market-driven economies has required new approaches for projections that better reflect the changed economic structure in EIT Parties. Most of these have used a combination of "top-down" macroeconomic models with sectoral models for energy end-use sectors of the economy and optimization models to project the development of energy supply. These models were used to produce consistent macroeconomic scenarios that incorporate projections of major macroeconomic indicators. Normally the use of models was supplemented by expert opinions on possible developments in different sectors. The approach did not generally allow for the simulation of fuel switching driven by relative changes in energy prices, or weighing mitigation options in energy supply versus energy efficiency measures in demand, as the relevant relations between economic variables cannot be estimated based on historic data. It also had limitations in simulating technological improvements. Therefore, several EIT Parties have recently started to utilize models such as MARKAL-MACRO which help to identify optimal mixes of energy technologies to provide the required level of energy services at minimum cost.

157. It was often unclear from the communications how policies and measures were reflected in the projections. In general, the approaches used did not allow complete representation of all policies and measures to the level of detail in which they had been implemented. In part, this is because there was insufficient information on the effects of individual policies and measures. In addition, the level of aggregation in some types of models was high. Still, some Parties (e.g. AUS, USA) provided detailed assessments where top-down and bottom-up methods were combined. The IDRs confirmed that, where national communications contained little detail, rough estimates that did not specify individual policies and measures were sometimes used. Several Parties noted that such aggregation made it difficult to account for overlap and synergies between different policies and measures. Some EIT Parties included relatively detailed estimates of the effects of significant policies and measures, such as future use of nuclear power and developments towards market prices, as well as the cost of mitigation options. Other EIT Parties presented highly integrated scenarios from which the effects of policies and measures in terms of greenhouse gas emission reduction could not be evaluated.

158. Important assumptions relating to GDP growth, energy prices and structural changes in energy demand and supply were made in the projections. Reflecting various situations, and the time span of the projections, these differed. They were generally in line with scenarios provided by authoritative international sources such as OECD, IEA and the World Energy Council. The IDRs showed that energy prices have often been lower than assumed and GDP growth higher, causing higher underlying growth in emissions. Differences in assumed prices for energy commodities will often have significant effects on emissions in the longer run. In many countries the assumptions regarding tax levels on such commodities as

gasoline, which is often heavily taxed, could be more important for consumer prices and emission developments than world market prices. The projected changes in population varied from declines, which could be significant in some EITs, to 10-15 per cent growth over the decade.

159. In the EIT countries, GDP decreased by 25 to 50 per cent after 1990, a situation assumed to have stabilized in 1994-1995. For some of them the projected growth rate from 1996 varied from 2 per cent to 5-6 per cent. The growth rate in some of these countries in 1995-1996 is at the upper end of the assumed range. The EIT Parties have reported as crucial the establishment of domestic energy prices consistent with costs and prices in the international markets (i.e. eliminating subsidies) as an inherent part of the transitional process. In most of these countries this process is at an advanced stage and only electricity, heat and gas supplies to the households are still subsidized.

160. Various types of uncertainty relating to natural variations and policy choices were reported by Parties and mentioned in the IDRs. A number of Parties provided sensitivity analyses of variations in some key inputs. Some also raised the issue of variations around trends caused by such factors as temperature fluctuations; precipitation; the business cycle and electricity trade; some Parties gave examples of emissions peaking in dry years because of low hydropower availability. Trends are generally influenced by the choice of fuels, especially for electricity production, by changes in behaviour, including tendencies to use electricity for more purposes, and by the effects of policies and measures, in addition to the economic factors mentioned above. To overcome the high level of uncertainty in EIT country projections, some of these Parties provided several scenarios that differed mainly in the assumptions regarding GDP growth, since this was considered the most important driving variable.

161. Four Parties (CHE, DNK, FRA, NLD) adjusted the 1990 figures used for projections to allow for short-term fluctuations. They did so in a transparent manner and expressed the view that, as conditions in projected years were assumed to be average, the adjustments made it easier to demonstrate how policies and measures influenced emissions. The reports from some Parties (DNK, NLD) reflected policy approaches that predated the UNFCCC and the reporting guidelines. The differences between these approaches, which led to adjustments in their 1990 figures, and the reporting guidelines were explained in the communications and examined in the IDRs. From the IDRs, it was clear that such short-term fluctuations apply to most countries to some extent, and many countries pointed out the need to deal with them in a uniform way under the Convention. This issue is discussed in more detail in document FCCC/SBSTA/1996/9/Add.1.

162. Several Parties noted that 1990 was warmer than normal. One Party (NLD) adjusted its inventory and the starting point for the projections by an amount equivalent to 4 per cent above the actual 1990 figure for CO_2. Two Parties (CHE, FRA) adjusted only the starting points for their projections in the same way, by 3-5 per cent. A number of Parties gave quantitative indications of what such an adjustment would have meant for them.

163. Several Parties mentioned electricity trade in relation to projections. One country (DNK) accounted for its net imports of electricity in 1990 by simulating production of that electricity from available plants within its own borders, which gave a figure equivalent to 12 per cent above the actual 1990 figure for CO_2. Others accounted for net electricity imports in theirs 2000 projections without attaching emissions to them, and yet another stated that emissions generated in producing exported or imported electricity were not taken into account in its projections. The communications and IDRs showed that assumptions and actual developments regarding electricity trade could have a crucial effect on whether or not stabilization levels are reached nationally. One Party (FIN) estimated that emissions would have increased by around 20 per cent if the amount of electricity that it imported in 1990 had been produced domestically. That particular import was mostly produced by hydro and nuclear power in the countries of origin. Further, the IDRs noted the increasing international integration of the electricity markets, in particular in Europe, creating additional uncertainty as regards future emissions.

164. Although Parties made efforts to comply with the guidelines definition of "with measures", the IDRs showed that in several countries there have been significant changes in the policies and measures implemented or committed to, for example in tax structure and funding level, since the communication was submitted. Some updates, which also reflect differences in economic development, are shown in a separate column in table B.1 and in footnotes to all tables.

165. Some Parties reported difficulties in projecting non-CO_2 gases, often because of lack of data. This has implications for the robustness of the projections, particularly for emissions of HFCs, PFCs, and SF_6. Several projections of non-CO_2 gas emissions and removals, reflected scenarios that incorporated few policies and measures or none at all. The IDRs confirmed that emissions of these gases exist in several more countries than those which gave projections. Largely introduced after 1990, projections of HFCs had to be made virtually without the support of historic data.

C. Projected anthropogenic emissions and removals in 2000

166. All Parties except Romania and Monaco provided information that constituted, or could be interpreted as, "with measures" projections. The guidelines requirement for "with measures" projections is that they take into account "the effects of policies and measures that were implemented or committed to when the communication was produced." Most Parties incorporated in their 2000 figures, to the extent possible, the effects of policies and measures that were being implemented or had been committed to when the communication was produced, often assuming that current funding levels would be continued. Some assumed only partial implementation of action plans and mitigation programmes, while others assumed full implementation and funding of planned activities. One Party included fewer policies and measures in its projections than had already been implemented. In some cases, projections were not made for all sectors. Some Parties did not include a "with measures" projection,

but provided a "without measures" or "reference" projection and estimated the effects of policies and measures on emissions separately, enabling a "with measures" 2000 level to be ascertained.

167. Different ways were used to present data in the communications. The presentation in tables B.1-B.8 is intended to make it possible for countries to recognize their own approaches. Tables B.1, B.3, B.4, B.5 and B.6 were presented in provisional form in document FCCC/SB/1996/1/Add.1. The SBSTA, at its second session, invited Annex I Parties to forward to the secretariat their suggestions relative to the presentation of inventory data on the land-use change and forestry sector for years subsequent to 1990, to projections for this sector, as well as to aggregating data on greenhouse gas sources and sinks from this and other sectors. No specific comments on the structure and content of these tables were received by the secretariat. However, reservations regarding the presentation of net figures were made in earlier submissions and in IDRs. Still a number of revisions were made to update the tables on the basis of information obtained from the IDRs and revised inventories. Those countries that have a net approach only to CO_2, will have to combine the information from tables B.1 and B.2 to arrive at net figures, but such information is also presented and discussed in document FCCC/SBSTA/1996/9/Add.1.

168. The tables allow to compare, for each Party, the projected emission and removal levels of greenhouse gases in 2000 with:

(a) The 1990 levels used as a basis for the projections; and
(b) The 1990 levels reflected in the inventory.

169. Separate tables are provided for CO_2 excluding the land-use change and forestry sector (table B.1), CO_2 from this sector including removals by sinks (table B.2), CH_4 (table B.3), N_2O (table B.4) and other greenhouse gases (table B.5). Updated information derived from the IDRs is presented in a separate column in the table for CO_2 and included in the main tables for non-CO_2 gases, where it often reflects more complete projections rather than changes in assumptions. To aggregate the emissions of all gases and to give a more effective presentation of HFCs and PFCs, and in accordance with decision 4/CP.1, the secretariat has used IPCC-1994 GWP values (100 years time horizon) for several tables. The use of GWPs is discussed in document FCCC/SBSTA/1996/9/Add.1, where it is noted that the GWP values were revised in 1995. The secretariat has developed GWP-based summary tables for all gases, with and without land-use change and forestry (tables B.6 and B.7), recognizing the concerns expressed by some countries regarding the procedure of adding emissions and removals from the land-use change and forestry sector to emissions from the other sectors to present net figures. Projections of precursors are presented in table B.8. The footnotes and notes should be treated as integral parts of the tables; they describe the projections used by each Party and explain any changes or calculations made by the secretariat and in updates based on the IDRs. The projections are not comparable and, in accordance with decision 2/CP.1, individual national totals are not added.

170. The tables reveal some differences between the 1990 levels obtained from the inventories and those used as the basis for the projections. These differences are due to rounding, calibration of models, updating of inventories subsequent to the projections being developed, and the fact that some did not include exactly the same sources in the projections as in the inventories. In four cases (CHE, DNK, FRA, NLD, SUI), such differences also reflect the use of adjustments. For CO_2 emissions (table B.1), in order to enhance comparability and transparency, it was necessary to include two columns for percentage variations. For non-CO_2 gases and the land-use change and forestry sector, one column for percentage variation sufficed as any differences between comparable figures were minor. In the case of tables B.6 and B.7, the projections for all gases mostly reflected only subsets of the inventory, and other inconsistencies were reported. Thus any comparison between the projection and inventory figures would be inappropriate.

171. Twenty Parties provided projections for one or more sectors for CO_2, 17 for CH_4 and 15 for N_2O. In addition to the fact that approximately half the Parties did not report, the definitions of sectors were often not transparent or did not follow the IPCC format, making assessment of projected trends problematic. Although more information on sectoral development was communicated during the IDRs, this information was not necessarily quantified and comprehensive. For CO_2, a clear message is that all Parties but one (LAT) projected increasing emissions from transport, while the picture for other sectors was less uniform. The IDRs confirmed the importance of national circumstances for these developments. CH_4 emissions from agriculture and waste are often projected to decrease, as are industrial emissions of N_2O and PFCs.

D. Estimate of the total effects of policies and measures on greenhouse gas emissions and removals

172. Article 12 requires each Party to provide a specific estimate of the effects that its policies and measures will have on anthropogenic emissions by its sources and removals by its sinks. According to the guidelines a specific estimate of total effects should, to the extent possible, take into account all policies and measures implemented or committed to since the base year. This requirement has been implemented in different ways. All Parties that gave projections represented total effects of policies and measures in their "with measures" projections for emissions of various gases and removals by sinks. Approximately half of the Parties gave separate quantitative estimates for the total effects of policies and measures for CO_2 emissions; some also gave figures for emissions of other gases and removals by sinks.

173. Some Parties adopted an aggregate approach and estimated the effects of groups of policies and measures. Others also gave detailed information on their policies and measures and then aggregated them, taking into account overlaps and synergies. Yet other Parties gave estimates for some policies and measures, but did not give figures for the total. Most Parties reported major methodological problems related to such estimates. Some Parties made qualitative statements on the issue, which was sometimes seen as the only possible way to

respond. Only a few documented the methods used in the communication but the IDRs confirmed that these were normally country specific and often relatively rough, although a few countries (e.g. AUS, SWE, USA) had detailed assessments. The IDRs also confirmed that countries monitor their programmes closely, and monitoring could eventually provide a basis for such estimates.

174. Most EIT countries constructed two ("business as usual" and "mitigation") or three ("high", "business as usual", "low") scenarios to illustrate the near and mid-term effects of policies and measures that could be implemented. The business-as usual scenario, often referred to as "most likely or realistic", incorporated major structural changes and assumed more than a minimum level of penetration of new technologies and improvements in energy efficiency and conservation. Some of the Parties identified the high scenarios as the most subjective, characterized by high economic growth, major change in economic development pattern, high energy prices improving energy efficiency, behavioural change towards energy saving and lower energy demand.

175. The range of reported estimates of total effects in 2000 was wide for all Parties. Reductions of between 4 and 20 per cent from baseline scenarios were reported for CO_2, and wider ranges for other gases, reflecting differences in policies, national circumstances and approaches to the estimates. Owing to the heterogeneous character of the information, the secretariat was unable to present it in tables.

176. In general, most of the Parties focused on measures induced by government policies. To a limited extent, they elaborated on the effects of actions by individuals or organizations that were not induced by such policies. Examples of such actions were discussed in the IDRs. One Party (NLD), for which energy conservation generated the bulk of estimated CO_2 reductions, said that "no distinction can be made between policy-induced and autonomous effects on energy conservation". Consequently, their estimate of the effects of these policies and measures was the difference between projections with and without energy conservation.

177. The IDR team in Sweden characterized that country's use of the internationally applied MARKAL model as innovative and potentially replicable in other countries. This approach made it possible to assess effects on CO_2 emissions of various energy conservation and renewables programmes on an equal footing with changes in the tax structure, including introduction of CO_2 taxes. It was estimated that the substantial tax shifts would account for 70 per cent of the expected reduction of 14 per cent over the decade compared to a baseline, although other programmes were also seen as quite comprehensive and well developed.

178. When giving their estimates, several Parties did not distinguish between policies and measures implemented or committed to before and after 1990. Some included policies and measures implemented in the 1990s in their baseline, while others included those implemented earlier. As policies and measures implemented both before and after 1990 could have effects on emissions, the IDRs covered both those included in baselines and those in the "with measures" scenarios.

E. Summary conclusions

179. Parties made considerable efforts to communicate emission projections. Usually, where the guidelines indicated that Parties "should" or "are encouraged" to present relevant data, the information was provided. The majority of the reporting Parties provided data for the three major greenhouse gases and presented projections for 2000; more than half of the Parties projected precursors and removals by sinks, and in several cases projections for other gases were also reported. Approximately half of the reporting Parties provided assessments or estimates of the total effects of measures, ranging from 4 to 20 per cent for CO_2 compared to baselines, and a wider range for other gases, often noting methodological difficulties. The projections are not comparable between Parties and the individual national totals have not been added.

180. The projections were developed using different approaches and assumptions, although the latter were often based on, or in line with, those used by authoritative international sources. Most Parties provided enough information to allow for a qualitative understanding of the approaches used and further elaborated on them during the IDRs, although it was often not clear from the communications which policies and measures were reflected. Four Parties adjusted their base year figures upward to account for electricity imports or climatic anomalies in the base year.

181. A comparison with inventory data was often not applicable since either Parties did not make projections for all gases reported in the inventories, or for all sources, or there were other differences. Some EIT Parties mentioned difficulties in making robust projections, due to the high level of uncertainty about economic growth, effects of the ongoing economic restructuring and insufficient statistical data.

182. All Parties but two (Monaco, Romania) provided "with measures" projections for CO_2, two Parties (Estonia, Germany) doing so after their communications were submitted. The projections reveal a different pattern for CO_2 (excluding land-use change and forestry sector) from that for other greenhouse gases. Seventeen Parties, accounting for about 61 per cent of 1990 CO_2 emissions, projected an increase to 2000 in the absence of additional measures. Fourteen Parties (Denmark, Germany, Luxembourg, Netherlands, Switzerland, United Kingdom and eight EITs) projected stabilization or decrease for 2000 in comparison to the base year levels. These represented 38 per cent of the 1990 inventories. In the EITs, the emissions decreased sharply in the first half of the 1990s. Some of them indicated that in the absence of additional measures their GHG emissions could start growing from 1994-1995, while still staying below the base year levels in 2000.

183. The IDRs demonstrated that for a number of Parties, higher growth in GDP, lower energy prices and a different implementation rate of policies and measures from that previously assumed are causing higher-than-anticipated growth in CO_2 emissions. For one Party (United Kingdom), reforms in the energy market resulted in fuel shifts and expected

reductions in emissions. During the in-depth review two other Parties (Ireland, Spain) reduced their estimates for the considerable emissions growth expected in this decade. Adjustments made by four Parties (Denmark, France, Netherlands, Switzerland) to their 1990 starting points for projections resulted in figures 3 to 12 per cent higher than the non-adjusted values, which changed the projections for three (Denmark, Netherlands, Switzerland) from growth or stabilization to reductions.

184. The IDRs also indicated that most Parties could face additional increases in CO_2 emissions after 2000 as a result of economic and/or population growth. In a number of Parties these increases were attributed to a freeze on new nuclear power capacity or decisions to phase it out, as well as to more self-reliance in electricity production. For all Parties but Latvia that provided sectoral projections, transport emissions were projected to grow, while both decreases and increases in emissions were projected for other sectors.

185. For seventeen Parties the land-use change and forestry sector was projected to remain a net removal, while Australia projected it to stay a net source, although a smaller one. Some Parties pointed out that in the longer term net removals will fluctuate around zero. For eleven Parties net CO_2 removals by the land-use change and forestry sector in 2000 were projected to increase, and three Parties (Denmark, Germany, United Kingdom) projected removals to remain stable. Latvia and Sweden indicated that their removals could be decreasing, while Finland presented a range with substantial increases and decreases both described as plausible options.

186. Projections for CH_4 emissions were provided by 26 Parties, although four of them did not include all major sectors. All but three of these Parties (Australia, Canada, Luxembourg), accounting for 60 per cent of the aggregated inventory figures for 1990, projected stabilization or decreases in CH_4 emissions from their base years, thirteen of them projecting decreases of 10 to 70 per cent. The Parties that projected increases accounted for 9 per cent of the aggregated inventory figures for 1990. Reductions in CH_4 emissions were often expected to be realized in the second half of the decade, reflecting, in particular, new waste treatment and disposal policies.

187. Fourteen Parties, accounting for 58 per cent of the aggregated inventory figure for N_2O for 1990, projected stabilization or decreases compared to their base years, four of them decreases of more than 35 per cent, often due to expected improvements in industrial processes. Ten Parties, accounting for 26 per cent of the aggregated inventory figures for 1990, projected increases, eight of these of less than 10 per cent. Fewer Parties provided projections for other gases and precursors but for those that did so, emissions of perfluorocarbons (PFCs) and precursors are often projected to decrease, while emissions of hydrofluorocarbons (HFCs) increase as they replace substances being phased out under the Montreal Protocol.

188. When all projected emissions (excluding land-use change and forestry) are totalled using IPCC-1994 GWP for all Parties, sixteen of them (Denmark, France, Germany, Iceland,

Luxembourg, Netherlands, Switzerland, United Kingdom and eight EITs), accounting for 42 per cent of the aggregated 1990 inventory figure, projected stabilization or decrease. Fifteen Parties, accounting for 55 per cent of the aggregated 1990 inventory, projected an increase; three of these (Japan, New Zealand and United States), accounting for 42 per cent of the aggregated 1990 inventory, projected an increase of 2 per cent or less. If unadjusted figures had been compared, one more Party (Denmark) would have shown an increase, while the other three (France, Netherlands, Switzerland) that applied adjustments would still show stabilization or decrease.

189. When the available data for land-use change and forestry reported by eighteen Parties are aggregated with other projected emissions, considerable differences between net and gross figures occur for several Parties. Eighteen Parties, accounting for 76 per cent of the aggregated inventory figure for 1990, projected stabilization or decrease for this sector. Eight of these were Parties with economies in transition. Thirteen Parties, accounting for 23 per cent of 1990 emissions, projected increases. If unadjusted figures had been compared, another Party (Denmark) would have shown an increase, while the other three (France, Netherlands, Switzerland) that applied adjustments would still have shown stabilization or decrease.

190. Sixteen Parties provided projections for the year 2000 for precursors. Of these, three (EST, FRA, GRE) did not report on CO, one (FRA) did not give projections for NO_X, and two (EST, GRE, HUN) did not forward information on NMVOC. One Party (DEU) only gave projections for 2005. All reporting Parties, with two exceptions for NO_X emissions (GRE, HUN), expect substantial reductions of precursor emissions for the year 2000. Many of the Parties that reported on precursors have accepted stabilization and/or reduction commitments on NO_X and NMVOCs under the UN ECE Convention on Long-Range Transboundary Air Pollution.

191. In due course, it will be possible to assess progress towards achievement of the aim of returning emissions to 1990 levels by 2000 by comparing the inventory figures for these two years. At present, a comparison of projections for 2000 with inventories for the base year and the information obtained from the IDRs, suggests that for the majority of Annex I Parties additional measures would be needed to return CO_2 emissions to their 1990 level by 2000. A similar comparison made using GWPs for all GHGs combined (excluding land-use change and forestry sector), indicates that several Annex I Parties could have difficulties in returning these emissions to their 1990 levels in 2000. Inventory data for 1991-1994 submitted to the secretariat so far by several of the Annex I Parties seem to justify this concern. Although an initial rise is not inconsistent with the aim of returning emissions to 1990 levels by 2000, it suggests that additional efforts may be needed in the remaining few years. Nevertheless, during the IDRs some indications were given that in a number of Parties which projected growth in emissions, return to their base year levels was felt to be within reach.

VI. FINANCE, TECHNOLOGY AND CAPACITY BUILDING

192. In accordance with Article 12.3 of the Convention, 20 out of 22 reporting Annex II Parties described measures taken to meet their commitments outlined in Article 4.3, 4.4 and 4.5. The majority of Annex II Parties reported on their contributions to the Global Environment Facility (GEF), some Parties stating explicitly that such contributions were new and additional. In addition to funding of the GEF some Parties reported on other means of financing through their official development assistance (ODA), see table 1.

Table 1. **Official development assistance as a percentage of gross national product, 1992-1994**

	1992	1993	1994
Australia	0.37	0.35	0.35
Austria	0.30	0.30	0.33
Canada	0.46	0.45	0.43
Czech Republic[a]	.	0.06	0.07
Denmark	1.02	1.03	1.03
Finland	0.64	0.45	0.43
France	0.63	0.63	0.64
Germany	0.38	0.36	0.34
Greece[a]	0.07	0.07	0.11
Iceland[a]	0.07	0.12	0.10
Ireland	0.16	0.20	0.25
Italy	0.34	0.31	0.27
Japan	0.30	0.27	0.29
Luxembourg	0.26	0.35	0.40
Netherlands	0.86	0.82	0.76
New Zealand	0.26	0.25	0.24
Norway	1.16	1.01	1.05
Portugal	0.36	0.29	0.35
Spain	0.27	0.28	0.28
Sweden	1.03	0.99	0.96
Switzerland	0.45	0.33	0.36
UK	0.31	0.31	0.31
USA	0.20	0.16	0.15

a/ Non-DAC donor.

Source: Development Assistance Committee Report 1995, OECD.

193. The information that was reported by the Parties[13] varied considerably in level of detail and breadth of coverage. Drawing comparisons between Parties was difficult as the time-frames and levels of expenditures, and types of assistance were not comparable in all instances. Information varied as some Parties provided specific figures for bilateral, regional and multilateral assistance while others provided a general overview of types and recipients of assistance. The delineation between general environmental and climate change specific activities was not always clear, neither in the level of assistance and time-frame nor in the type of activity (adaptation or mitigation), and therefore a comparative summary could not be undertaken.

A. Financial mechanism

1 Global Environment Facility

194. The Global Environment Facility is designated as the entity entrusted with the operation of the financial mechanism on an interim basis. Fifteen Parties (AUS, AUT, CAN, CHE, DEU, ESP, FIN, FRA, GBR, ITA, JPN, NLD, POR, SWE, USA) mentioned their contribution to the pilot phase; two (DNK, NOR), although being contributors, did not mention their contribution in the national communications but did so during the IDRs. Five (GRE, ICE, IRE, LUX, NZL) did not contribute to the pilot phase.

195. Seventeen Parties (AUS, AUT, CAN, CHE, DEU, DNK, ESP, FIN, FRA, GBR, IRE, ITA, NLD, NZL, POR, SWE, USA) mentioned their contributions or pledges to contribute to the replenishment of the restructured GEF; three (GRE, JPN, NOR), although being contributors, did not mention their contribution in national communications but the last two indicated that during the IDRs. Iceland and Luxembourg did not contribute to the replenished GEF.

196. The figures for the pilot phase and restructured GEF reported by contributing Parties were consistent with those published by the GEF secretariat (see table 2). The funding from reporting Parties constitutes 92 per cent of total funding for the pilot phase and 95 per cent of total funding for the restructured GEF.

197. The GEF provides grant and concessional funds to recipient countries for projects and activities aimed at protecting the global environment. The GEF resources are used to fund four focal areas, one of which is climate change. As of December 1995 the GEF had accepted into its work programme on climate change (pilot phase and restructured GEF) 62 projects totalling US$ 328 million, constituting 36 per cent of total resources allocated to the various focal areas. Although climate change is only one of the four focal areas, the

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[13] All references to Parties in this section are to Parties included in Annex II.

share of climate change projects in total expenditures is envisaged to grow significantly in the coming years.

Table 2. Contributions to the GEF from reporting Parties (for all focal areas)

	Pilot phase	Restructured GEF (1994-1997)	
	(millions US$)[a]	(millions SDR)[b]	(millions US$)
Australia	22.1[c]	20.8	29.2
Austria	36.0[d]	14.3	20.0
Canada	18.3[c]	61.8	86.5
Denmark	23.4[c]	25.1	35.1
Finland	20.6[c]	15.5	21.7
France	149.5[e]	102.3	143.2
Germany	149.0[e]	171.3	239.8
Greece		3.6	5.0
Ireland		1.7	2.4
Italy	68.2[e]	81.9	114.7
Japan	95.0[f]	296.0	414.3
Netherlands	52.8[c]	51.0	71.4
New Zealand		4.0	5.6
Norway	28.6[c]	21.9	30.7
Portugal	6.5[c]	4.0	5.6
Spain	14.7[c]	12.4	17.3
Sweden	25.5[c]	41.6	58.2
Switzerland	57.2[c]	32.0	44.8
UK	62.4[c]	96.0	134.5
USA	150.0[c]	306.9	429.7
Total	**993.2**	**1,364.1**	**1,909.7**

a) Based on real exchange rates for realized encashments, and exchange rates as of 30 September 1994 for future encashments.
b) Contributions were converted from SDRs into US$ based on average daily exchange rates over the period 1 February 1993 to 31 October 1993 (1 SDR = US$ 1.401).
c) Core fund only.
d) Co-financing/parallel financing.
e) Core fund and co-financing.
f) Core fund and co-financing (grant equivalent).

Source: GEF secretariat.

2. "New and additional" and official development assistance

198. More than half of the Parties mentioned financial resources as being "new and additional", "additional", "expanded" or "new ways and means". Seven Parties (AUS, CAN, CHE, GBR, FIN, FRA, NZL) indicated explicitly or implicitly that their GEF contributions were new and additional and that they had thus fulfilled their commitment. Nevertheless, the relevant financial contributions of other Parties cannot necessarily be considered as not meeting the new and additional financial resources commitment. It should be noted that beginning in 1996, member countries of the Development Assistance Committee (DAC) may report up to a maximum of 84 per cent of their contributions to the GEF as ODA. This could make it difficult to distinguish whether GEF contributions are new and additional.

199. As GEF operations are intended to complement, not substitute for development aid programmes, resources aim to facilitate projects with global environmental benefits for which official development funds are not normally available. The Instrument for the Establishment of the Restructured GEF (the GEF Instrument) states that the GEF shall operate "as a mechanism for international cooperation for the purpose of providing new and additional grant and concessional funding". Therefore, by agreement of participating Parties, financing through this mechanism is to be new and additional.

200. In addition to financial resources provided through the GEF some Parties mentioned other financial mechanisms such as ODA. Several Parties indicated their intention to reach the United Nations suggested level of ODA of 0.7 per cent of GNP in the future. Due to recent economic and budget difficulties in several donor countries, ODA has not been increasing in recent years (in real terms it has in fact declined since1992).

201. After a 5 per cent decline in real terms in 1993, aggregate ODA increased by $2.5 billion in nominal terms in 1994 according to preliminary data[14] while remaining steady in real terms. In 1994 both bilateral grants and contributions to multilateral institutions increased slightly in real terms while bilateral loans decreased in real terms. However, for the third consecutive year ODA as a percentage of OECD Development Assistance Committee (DAC) members' total GNP declined. In 1994 DAC members' total ODA as a percentage of their combined GNP was only 0.30, the lowest level since 1973.

202. The proportion of ODA directly targeted to projects and programmes with an environmental emphasis has been limited. In 1993, 5 per cent of new ODA commitments were reported as being specifically for environmental purposes. Of those commitments the majority target urban and industrial pollution control, but activities related to natural resource management are increasing.

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[14] Development Assistance Committee Report 1995, OECD.

B. Financial resources transferred through bilateral, regional and multilateral channels

1. Bilateral channels

203. Eighteen Parties reported on bilateral activities and more than half of those devoted specific sections to the subject in their communications. Some of the themes discussed included energy conservation and efficiency, renewable energy, technology transfer, forest management, capacity building, adaptation and debt reorganization (debt-for-environment swaps) (see box 9). The following were the most commonly mentioned activities:

(a) Renewable energy (for example, biomass, hydro, photovoltaic/solar systems and wind) (AUS, CAN, CHE, DEU, ESP, FIN, FRA, GBR, ITA, JPN, NLD, NOR, NZL, SWE, USA);

(b) Energy efficiency (for example, upgrading of transmission lines, restructuring and demand-side management, such as pricing, subsidies and tax incentives) (AUS, CAN, CHE, DEU, FIN, FRA, GBR, ITA, JPN, NLD, NZL, SWE, USA);

Box 9. Examples of bilateral activities

Finland - introduction and development of new technologies in electricity generation combined with heat and power generation, including the circulating fluidized bed boiler (China), district heating (Zambia) and advanced diesel power plant technologies (Egypt and Nepal).

Italy - development of micro-hydro power plants (Argentina and Peru) and geothermal power plants (Indonesia).

Japan - joint research and development project with Egypt for soil improvement and the development of water-retaining agents using highly absorbent resins.

United States - US Country Studies Programme supports various activities in numerous countries, such as: preparation of GHG inventories; assessment of vulnerability and evaluation of adaptive responses to impacts of climate change; analysis of mitigation options; development of national plans; and public education and outreach activities.

(c) Forest management, sink enhancement and afforestation programmes (AUS, CAN, CHE, DEU, FIN, FRA, GBR, ITA, JPN, NLD, NOR, NZL, USA);

(d) Energy planning (for example, promoting methodologies and techniques for rational energy use, and promotion of energy conservation indirectly through urban planning) (AUS, CAN, CHE, DEU, DNK FIN, FRA, GBR, ITA, JPN, NLD, USA);

(e) Climate change research (for example, on forestry, meteorology, methane emissions and sealevel rise (AUS, CAN, CHE, DNK, FIN, FRA, GBR, ICE, ITA, NLD, USA).

2. Regional channels

204. More than half of the Parties reported to some degree on regional activities, although the discussion was limited. Parties referred to their participation in regional organizations and to activities carried out on a region-wide basis. The majority of activities concerned capacity building, such as training and seminars, support for implementation of national plans and assistance with emissions inventories, evaluation of impacts and analysis of response options, and general scientific and technical assistance. Regional research activities were also noted by a number of Parties.

3. Multilateral channels

205. Multilateral cooperation is an important element in many of the national communications. Several Parties indicated their support for multilateral organizations engaged in work related to capacity building, research, and information transfer. Contributions to the Global Environment Facility were reported by virtually all Annex II Parties, but contributions to other multilateral financial institutions were not reported in a consistent fashion. For example, although most Annex II Parties make contributions to the World Bank and various regional development banks, these were reported by a few Parties only.

206. The majority of Parties mentioned participation in and support of various multilateral activities and organizations. Contributions to the Intergovernmental Negotiating Committee trust funds and the IPCC to support these activities, including the funding of the participation of developing countries was often mentioned. There was no common approach to reporting the financing of the various multilateral activities and organizations, but the most commonly mentioned activities it this connection were:

(a) Activities under the Tropical Forestry Action Programme and the International Tropical Timber Organization;

(b) The South Pacific Regional Environment Programme for national participation in multilateral negotiations;

(c) The IEA/OECD GREENTIE programme;

(d) The World Climate Research Programme and the International Geosphere-Biosphere Programme;

(e) The global shelter strategy (proper urban planning and promotion of energy conservation) of the United Nations Centre for Human Settlements;

(f) The International Centre for Agroforestry and the Centre for International Forest Research; and

(g) The various ongoing programmes of the United Nations Economic Commission for Europe, FAO, OECD and IEA, the International Institute for Applied Systems Analysis, UNDP, UNESCO, UNEP, UNIDO, WMO and multilateral and regional development banks.

C. Transfer of technology

207. In accordance with Article 4.5, which deals with the transfer of, and access to, technology and know-how, the guidelines request Annex II Parties to submit information on the transfer of technology by governments and the private sector. Other Parties in a position to do so are also urged to assist in facilitating the transfer of such information.

208. The section of the guidelines on technology transfer is very general in nature and easily subject to different interpretations by the Parties. As a result, the information contained in Annex II communications differs considerably in format, comprehensiveness and level of detail. Most Annex II national communications also focus on government-supported multilateral and bilateral cooperation rather than private sector cooperation. Moreover, discussions held during the in-depth review visits have revealed that much more information is available than has been provided in the communications, but has not been compiled and presented in an organized manner by the Parties. Therefore, a comprehensive picture of technology transfer activities is not available at the present stage. Parties may wish to refer to document FCCC/SBI/1996/5 for a further discussion of this issue.

209. A number of Parties provided considerable data on their official development assistance (see section VI.A.2 above), but it was often difficult to distinguish the portion that was related to climate change, and the relationship between such multilateral financing and transfer of technology was not usually clear.

210. Bilateral cooperation in the transfer of technology was reported by most Parties, but the comprehensiveness and level of detail of the information differed greatly. For example, one Party gave detailed information on more than 30 bilateral projects directed at greenhouse gas mitigation in developing countries and countries with economies in transition. Most other Parties, however, provided only a general overview of their bilateral projects. Some Parties highlighted information on one or two examples of such projects.

211. Bilateral cooperation related to the transfer of "hard" technologies was reported more often than activities related to the transfer of "soft" technologies through capacity building, training and research. The technologies most frequently concerned were those to reduce

greenhouse gas emissions or enhance carbon sequestration in forests, to secure energy supply, or to satisfy energy demand in the residential, commercial, or industrial sectors. Only four Parties specified bilateral projects that would facilitate climate change adaptation.

212. Six Parties reported on action they had taken to facilitate the transfer of technology through the private sector. For the most part, these activities were directed at linking their own private sector companies with private companies in developing countries. Some Parties also indicated that they supported private sector investments either directly (through joint ventures) or indirectly (by feasibility studies). The investment flows, in particular the portion relevant to climate change, were poorly reflected in the national communications.

D. Capacity building

213. Under Article 4.5 developed Parties undertake to support the development and enhancement of endogenous capacities of developing countries. The majority of Parties included assistance for capacity building either explicitly or implicitly in their discussions on bilateral channels of assistance. The activities may be summarized as follows:

(a) More than half of the Parties referred to general or managerial training in relation to energy (efficiency and renewable energy), forestry, natural resources, impacts and vulnerability, technology and meteorology;

(b) About half of the Parties reported on country study activities, including development of inventories and databases, identification of mitigation and adaptation response options and development of strategies;

(c) About one third of the Parties mentioned research activities to strengthen the capacity of developing countries, including exchanges and funding of joint projects;

(d) Five Parties referred to capacity-building efforts aimed at meteorological and climatological services;

(e) Only three Parties reported on activities for institution building, such as the development of legislation and regulations.

E. Adaptation

214. Article 4.1(e) requires Parties to cooperate in preparing for adaptation to the impacts of climate change. Less than half of the Parties reported explicitly or implicitly on cooperation with developing countries in activities related to adaptation and vulnerability assessment.

215. The types of projects and activities that were most often described dealt with studies of vulnerability assessment and potential impacts, including natural hazard prevention and disaster control, adapting agriculture to the impact of climate change, ecosystem

management, coastal zone management, studies of sealevel rise and capacity building of meteorological services.

F. Assistance to countries with economies in transition

216. Half of the Parties reported on activities to assist countries with economies in transition. The majority of these cooperative activities related to capacity building and technology transfer, and were thus relevant to the implementation of Article 4.5.

217. Both bilateral and multilateral activities were reported, as were activities to promote commercial partnerships. The activities mentioned encompassed:

(a) Enhancement of capacities through country studies, inventories assistance, and policy planning and formulation;

(b) Institution building through assistance in increasing plant safety (nuclear), improvement of technical systems and stiffening of regulatory regimes;

(c) Transfer of technology through technological and commercial partnerships, including partnerships and cooperative arrangements for pipeline production and gas transportation;

(d) Efforts to increase energy efficiency in the transportation and residential sectors, the conversion of power plants to more efficient technologies, and promotion of renewable energy sources;

(e) The role of the European Union's PHARE and TACIS programmes in providing assistance to the energy sector; and

(f) Mobilization of commercial resources through credits or feasibility studies for joint ventures.

G. Summary conclusions

218. Most of the Parties reported on activities implemented through bilateral, regional and multilateral channels. Due to the varying degree and breadth of reporting it was not possible to quantify aid flows supportive of the Convention at an aggregate level and it was therefore difficult to draw a comparative summary of the comprehensiveness of activities.

219. The majority of Parties discussed support for the transfer of technology through multilateral and bilateral cooperation, and in a few cases through private sector cooperation. The information differed considerably in format, thoroughness and level of detail and consequently a comprehensive portrayal of technology transfer activities is not possible at this stage. The bilateral cooperation activities reported were often related to "hard" technologies rather than to the "soft" technologies of capacity building, training and research.

220. In their discussions on bilateral channels of assistance, the majority of Parties either explicitly or implicitly touched on assistance in capacity building. The areas of assistance

most often referred to were: general or managerial training in relation to energy (efficiency and renewable energy), forestry, natural resources, impacts and vulnerability, technology and meteorology; country study activities, including development of inventories and databases, identification of mitigation and adaptation response options and development of strategies; research activities to strengthen the capacity of developing countries, including exchanges and funding of joint projects.

221. About half of the Parties reported on cooperation with developing countries in activities related to adaptation and vulnerability assessment. The types of projects and activities that were most often discussed dealt with studies of vulnerability assessment and potential impacts, including natural hazard prevention and disaster control, adapting agriculture to the impact of climate change, ecosystem management, coastal zone management, studies of sealevel rise and capacity building of meteorological services.

222. Half of the Parties reported on activities to assist countries with economies in transition. The majority of these cooperative activities involved capacity building and technology transfer, and were thus relevant to the implementation of Article 4.5. The activities included: the enhancement of capacities through country studies, inventories assistance, and policy planning and formulation; institution building through assistance for increasing plant safety (nuclear), improvement of technical systems and stiffening of regulatory regimes; the transfer of technology through technological and commercial partnerships, including partnerships and cooperative arrangements for pipeline production and gas transportation; efforts to increase energy efficiency in the transportation and residential sectors, the conversion of power plants to more efficient technologies, and the promotion of renewable energy.

VII. IMPLEMENTATION OF OTHER COMMITMENTS AND RELATED ISSUES

A. Expected impacts of climate change, vulnerability assessment and adaptation

1. Expected impacts of climate change and vulnerability assessment

223. With regard to commitments under Article 4.1(b) and (e), 23 national communications discussed, in varying detail, the vulnerability of ecosystems, economic sectors and society and the expected impacts of climate change thereon.[15] The communications generally treated the expected impacts of climate change and vulnerability to climate change as a single issue, but more often addressed the former. The other reporting Parties either did not indicate any

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15. "Vulnerability" and "impact" are defined as in the *IPCC Technical Guidelines for Assessing Climate Change Impacts and Adaptation*, WMO/UNEP, Geneva, 1994, p.3.

impacts (EST, FRA, HUN, JPN, LAT, LUX, MON, ROM), or only mentioned isolated possible climate change impacts, or mainly referred to ongoing or planned research.

224. Fourteen communications included information on a national climate change scenario (derived from existing models) which was used as a basis for assessing potential impacts and vulnerability. The uncertainties regarding the scenarios were noted, particularly the inadequacy of global models for predicting regional or national climate change. Different time-scales and key assumptions were used to predict possible temperature increases or other climate change impacts.

225. Uncertainties with regard to the predictions of climate change were mentioned by some Parties as a fundamental problem in assessing possible impacts of climate change and the consequent vulnerability of ecosystems, sectors of the economy and society. It was emphasized that improving the predictions of national or regional climate change was the essential first step. In addition, many communications mentioned that impacts and vulnerability were difficult to assess due to the complexity of the systems and the interactions among several factors. Italy and Finland stated directly that there was no measurable impact yet from other than natural causes. The Russian Federation reported that climate change had an impact on Russian forestry.

226. In most cases possible impacts and vulnerability were described qualitatively, but Australia and Bulgaria assessed possible losses in some crops important for them. The Russian Federation estimated as possible a 12 per cent decrease in grain and a 5 per cent increase in pasture productivity, respectively. Slovakia estimated a decrease of 20 per cent in water resources for the period 1990-2030. The United States estimated the impacts and vulnerability in terms of the extra costs (in the range of 0.3 to 2 per cent of GNP) that would be incurred to cope with the impacts or in terms of damage costs provoked by a temperature increase of 2-3 degrees Celsius. The Netherlands estimated that the extra costs created by a sealevel rise of 60 to 100 cm over a period of 100 years would be in the order of Dfl 11 to 18 billion, respectively. They also estimated that an unfavourable change in wind direction combined with a 120 per cent increase in wind intensity would lead to a similar level of costs. All 23 Parties which reported possible climate change impacts, referred to negative impacts, but five also mentioned positive ones.

2. Adaptation measures

227. Twenty-one Parties included some discussion of adaptation measures. Several mentioned the constraints imposed by uncertainties with regard to the magnitude, timing and regional distribution of climate change, as well as the potential impacts of those changes.

228. Eleven Parties mentioned adaptation measures other than research that are already being implemented or are being developed. Most of these measures are also targeted to other current needs. Some Parties also mentioned supporting measures to achieve a better

adaptation to climate change impacts such as administrative changes, and management plans and strategies. Also eleven communications mentioned possible adaptation measures to be considered in the future. Some of the measures that Parties have implemented so far are presented below:

(a) Change to mixed stands or changes in border species (AUT, BUL, NLD, RUS, SLO);

(b) Modification of construction design codes and other regulations or measures for coastal construction projects (ITA, NLD, NZL, POR, USA);

(c) Changes in varieties, crop cultivation and other agriculture techniques changes (BUL, GRE, SLO, USA);

(d) Diversification of tourist and recreational activities (CAN);

(e) Promulgation of regulations and laws which focus on climate change (AUT, POL, SLO, SWE, USA).

229. Thirteen Parties reported on research to assess climate change impacts and vulnerability or to develop adaptation strategies.

230. The relatively low degree of reporting about vulnerability and adaptation by the Parties indicates that the existing level of uncertainty in regard to this issue is high, rather than a non-fulfilment of the current guidelines.

B. Research and systematic observation

231. With regard to Articles 4.1(g) and 5, most Parties included in their communications some information on research and systematic observation. On the other hand, the scope of coverage, depth and level of detail varied widely. In this respect, the IDRs were helpful in allowing Parties to describe their activities in this field in sufficient detail.

232. Research activities covered a wide spectrum including scientific research, climate change impacts and response adaptation measures. Also receiving considerable attention was research into greenhouse gas emissions, particularly in the energy field but also in other areas such as agriculture and forestry.

233. Scientific research included not only atmospheric chemistry but also studies on regional climate change and sealevel rise. Considerable attention is being given to the development of global circulation models (GCMs) and climate system models (CSMs). The Hadley Centre for Climate Prediction and Research (in the United Kingdom) is an excellent example of progress in this area, as was demonstrated during the IDR.

234. Research into the impacts of climate change is being carried out in a wide range of sectors including agriculture and forestry, hydrology and water resources and public health. Impacts on terrestrial ecosystems and marine and coastal environments are also receiving

attention as are the impacts on extreme weather events. Research and development in technological and socio-economic fields were mentioned by several Parties.

235. Considerable research is being carried out in the energy sector, particularly as concerns energy efficiency and management, and covering energy use in the industrial, residential and governmental subsectors as well as in transportation.

236. Although most Parties indicated that current research is taking place nationally, mainly in government and other recognized scientific establishments belonging to universities and other academic institutions, a number also stated that they participated in international research activities particularly those organized under the World Climate Research Programme (WCRP), the International Geosphere-Biosphere Programme (IGBP) and the Man and the Biosphere (MAB) programme. Many also mentioned their active participation in the work of the IPCC.

237. Several Parties (CAN, CHE, ESP, FIN, FRA, GBR, IRE, JPN, NLD, NOR, NZL, POL, SWE, USA) provided information on the funding of research activities while others made only passing reference. The manner in which the information was provided, however, was not such that it could be compared between countries. One Party, for example, provided detailed budget figures for each research activity while others indicated only orders of magnitude or in some cases sources of funding only. No specific mention was made of the transfer of research results to developing countries.

238. As far as systematic observation is concerned, only about half of the Parties reporting made reference to activities in this field. Of these, some mentioned only provisions for monitoring and measuring greenhouse gas emissions and sinks. Others provided information on national meteorological, climate and hydrological networks and on their contributions to international programmes such as the World Weather Watch (WWW), the Global Atmosphere Watch (GAW) and the Global Climate Observing System (GCOS) coordinated by WMO, as well as the Global Oceans Observing System (GOOS) coordinated by Intergovernmental Oceanographic Commission of UNESCO.

239. A number of Parties made reference to national data banks and archiving activities, as well as to their contributions to international data banks or programmes such as the European Climate Support Network, the Global Network for Detection of Stratospheric Change, the North Atlantic Climatological Data Set (NACD) and the WMO World Climate Data Centres.

C. Education, training and public awareness

240. With regard to commitments under Articles 4.1(i) and 6, the issues of public awareness, information dissemination, education, training and participation were, in general, fairly well described. Many communications provided an extensive account of the initiatives

taken in this area while others described only a few specific projects to illustrate the general approach. The coverage and input of the initiatives were not well documented.

241. Action taken to incorporate scientific, policy and social dimensions of climate change into the education process was reported in the area of formal education. Primary and secondary schools were the main focus, through curricula reform and periodic mailing of teaching material to schools. Many of the initiatives, however, referred to general information, of which only a part related to climate change.

242. Training activities focused on energy efficiency programmes for architects, maintenance personnel and drivers. Accounts of managerial and scientific training were less frequent. Training programmes were mostly designed for practitioners, and in some cases, "training the trainer" programmes were mentioned.

243. The programmes relating to public awareness focused on campaigns to provide information on the effects of climate change and to promote the social acceptability of policies through voluntary action to reduce emissions. The information campaigns described were aimed at the general public, although a number did focus on specific groups, such as motor vehicle users, households, local authorities, farmers and key industries. Most campaigns were run by governments, usually under the auspices of environment ministries. In a minority of cases non-governmental organizations, local authorities and utilities were reported to have organized independent campaigns. The themes of the campaigns centred mostly on the promotion of energy-efficient behaviour for the reduction of CO_2 emissions, including practical guidance in some cases. Other areas of focus included the effects of climate change, the promotion of renewable energy resources and the protection of forests. The tools used most frequently were pamphlets, brochures and newsletters, although many other instruments were mentioned, such as television and radio broadcasting, advice centres, telephone line services, fairs, seminars and billboard advertisements.

244. With regard to public participation, a majority of the communications described explicitly the process leading to the formulation of the national strategy or action plan to combat climate change, in which constituencies other than government ministries and agencies were actively involved. Five Parties (AUS, CAN, CHE, CZE, DEU) specified that a major consultative process had been launched to incorporate the opinions of non-governmental organizations, the business community, local authorities and others.

245. Public participation in the form of collaborative action and partnerships between the Government and other groups was described in the majority of communications, although the extent of public involvement varied considerably. Partnerships were most frequently described in relation to business, industry, and non-governmental organizations. Independent initiatives of groups and organizations outside the public sector were less frequently described. Most schemes were launched by the business community, but local authorities and non-governmental organizations also played an important role.

246. Only a few Parties (e.g. CAN, LAT, NLD) commented on the form and effectiveness of their education, training and public awareness programmes. One Party (LAT) stated that it perceived its current efforts as insufficient, mainly because of financial constraints. Only one Party (NLD) attempted to quantify the effectiveness of the actions by evaluating programme results, multidimensional indicators testing, and monitoring environmental behaviour. One such study indicated that it appeared difficult to maintain fairly high levels of public involvement in climate change issues through campaigning when financial incentives were not a strong enough motivation.

D. Integrating climate change considerations into policies and the identification and review of policies and measures leading to greater levels of emissions

247. With regard to commitments under Article 4.1(f), several communications made direct reference to climate change considerations in the context of social policies (for example, improvements in education and training, research into the socio-economic impact of climate change and health-related issues). Explicit mention of the incorporation of climate change considerations into economic policies was made in only a few communications. In all of the communications, however, many of the policies described to reduce emissions indicated that countries are including such considerations in economic policy-making. All Parties mentioned specifically the introduction of climate change considerations into environmental policies, in the form of climate change components of national environmental plans, climate change strategies and plans, or the setting up of processes and committees to address the issues.

248. Under Article 4.2(e)(ii), each Annex I Party is required to "identify and periodically review its own policies and practices which encourage activities that lead to greater levels of anthropogenic emissions of greenhouse gases ... than would otherwise occur". In general, explicit reference to this article was not made. Most communications, however, did provide instances of changes in policies and practices (for example, the removal of subsidies, changes in agricultural policy and land-use practices and changes in tax structure).

249. During the IDRs many Parties presented extensive information on the above-mentioned issues. The main findings can be found in the individual in-depth review reports.

E. Other issues

250. According to Article 4.6, a certain degree of flexibility is to be allowed by the Conference of the Parties to the EIT Annex I Parties, including with regard to the historical level of anthropogenic emissions of GHG. Four EIT Parties (BUL, HUN, POL, ROM) chose base years other than 1990 when reporting their national emission inventories, referring to the above-mentioned article. Only a few EIT Parties have so far submitted their inventory data for years subsequent to 1990, as requested by decision 3/CP.1. It was not clear from

the communications or in-depth reviews whether these Parties explicitly requested the certain degree of flexibility referred to in Article 4.6. The Conference of the Parties may wish to clarify the situation.

251. The guidelines do not specifically mention activities implemented jointly, and few Parties reported on these activities in their national communications, although this subject was frequently raised during the in-depth reviews. For a detailed discussion of issues related to activities implemented jointly see document FCCC/CP/1996/14 and Add.1.

Table 3. National GHG emission targets

Party	Target	Gas(es) concerned	Base level	Target year	Remarks
Australia	stabilization additional 20% reduction	GHGs GHGs	1988 1988	2000 2005	Provided other countries do not achieve "unjustifiable advantage" in trade competitiveness and if similar measures are taken by other major GHG emitters
Austria	20% reduction	CO_2	1988	2005	
Bulgaria	should not exceed	GHGs	1988	2000	
Canada	stabilization	net GHGs	1990	2000	On a GWP basis
Czech Republic	stabilization	CO_2, CH_4 and N_2O	1990	2000	But invokes Art.4.6 flexibility clause
Denmark	5% reduction additional 20% reduction	CO_2 CO_2	1990 -adjusted 1988 -adjusted	2000 2005	Additional reduction represents a contribution to the EU common reduction goal and is based on targets for the energy and transport sectors
Estonia					No national target communicated
Finland					No national target communicated
France	total Annex I emissions to return to 1990 levels	CO_2	1990	2000	Will undertake cost-effective measures so long as economic competitiveness is not threatened, and supports mitigation efforts to be undertaken at the EU level
Germany	25% reduction	CO_2	1990	2005	
Greece	limit CO_2 growth to 13%.	CO_2	1990	2000	
Hungary	return to	CO_2	average 1985-1987 levels	2000	

Table 3. National GHG emission targets

Party	Target	Gas(es) concerned	Base level	Target year	Remarks
Iceland	maintain	GHGs	1990	2000	
Ireland	limit CO_2 growth to 20%	CO_2	1990	2000	Or 11% net increase including sinks, consistent with EC CO_2 stabilization target
Italy	limit net carbon-related emissions	CO_2	1990	2000	Reflects EC commitment to stabilize CO_2 emissions in the Union as a whole at 1990 levels by 2000
Japan	stabilization efforts to stabilize stabilization stabilization to extent possible	CO_2 on a per capita basis total CO_2 CH_4 N2O and other GHGs	about 1990 about 1990 1990 1990	2000 and beyond 1994 1994	
Latvia	stabilization	GHG	1990	2000	Emission levels may grow after 2000 or even earlier
Liechtenstein	20% reduction	CO_2	1990	2005	
Luxembourg	at least a 20% reduction	CO_2	1990	2005	
Monaco					No national target communicated
Netherlands	3% reduction 10% reduction	CO_2 CH_4	1990 -adjusted 1990	2000 2000	
New Zealand	stabilization	net CO_2	1990	2000	
Norway	limit CO_2 to not exceed 1989 levels in 2000	CO_2	1989	2000	Preliminary target, to be considered in light of further studies, technological advances, international energy market development, international negotiations and agreements

Table 3. National GHG emission targets

Party	Target	Gas(es) concerned	Base level	Target year	Remarks
Poland	stabilization	emissions[a]	1988	2000	
Portugal	limit CO_2 growth to 40%	CO_2	1990	2000	Consistent with the EC CO_2 stabilization target
Romania	for comparison purpose	GHGs	1989	2001	No official target communicated
Russian Federation					No official target established, but year 2000 / 1990 can be a reference
Slovakia	stabilization 20% reduction	GHGs CO_2	1990 1988	2000 2005	
Spain	limit energy-related CO_2 growth to 25%	CO_2	1990	2000	Affects energy sector emissions only and is consistent with EC CO_2 stabilization target
Sweden	stabilization	CO_2	1990	2000	
Switzerland	stabilization further reduction	CO_2 CO_2 and other GHGs	1990 / adjusted	2000	
United Kingdom	return to 1990 levels	CO_2 and each major GHG	1990	2000	EC CO_2 reduction of 14 to 8% below 1990 levels is expected for 2000
United States	reduction	net GHGs	1990	2000	On a GWP basis

N.B. This summary table should be taken as a reference only. National targets were not always stated in a clear way. The secretariat would appreciate any updates, corrections and/or amendments made by Parties so that this summary table could clearly reflect current national targets.

[a] Base year levels corrected for electricity imports/exports.
[b] Base year level adjusted for temperature variations.